



THE ROYAL SOCIETY of WESTERN AUSTRALIA

P R O M O T I N G S C I E N C E

14th ANNUAL POSTGRADUATE SYMPOSIUM

29th September, 2012

PROGRAMME AND ABSTRACTS



Curtin University





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MESSAGE FROM THE RSWA PRESIDENT

Welcome to the Royal Society of Western Australia's 14th 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 Curtin University for hosting the symposium and the Department of Applied Geology for sponsoring the venue for 2012. 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 Philip O'Brien

ABOUT THE ROYAL SOCIETY OF WESTERN AUSTRALIA

The Royal Society of Western Australia is the premier society for scientists in Western Australia, and while there are innumerable specialist societies and associations now in the sciences, our Society remains the only holistic multidisciplinary association for scientists in the State.

The objective of the Society is the advancement of science in Western Australia. Throughout its nearly 100-year history, the Society has pursued this objective through publication of scientific papers and through monthly meetings. The Society now holds monthly meetings where scientists present interesting results of their research, it publishes a quarterly peer-reviewed scientific journal, *The Journal of the Royal Society of Western Australia*, holds symposia and workshops on thematic issues, promotes science to the public during National Science Week and holds the Annual Postgraduate Symposium.

The origin of the Royal Society of Western Australia indirectly lies in a history dating back to the original Royal Society (of London) that began with a group of scientists meeting in the mid-1640s to discuss the newly emerging philosophy of Science. Since the time of its official foundation in 1660, the Royal Society (of London) has seen a number of luminaries as Presidents including Robert Boyle, Sir Isaac Newton, Sir Joseph Banks, Sir Humphrey Davy and Lord Kelvin, all noted for their major contributions to science. Early in Australia's history, the various States inaugurated Royal Societies modelled on the original Royal Society, and in this regard, the Royal Society of Western Australia carries on this tradition. In essence, therefore, its roots lie in the model of the original Royal Society of the 1600s: the Royal Society of Western Australia has monthly scientific meetings, a scientific Journal, and a President and Council that run the affairs of its members. As part of its charter, the Royal Society of Western Australia also hosts Public Forums on topical issues.

The Royal Society of Western Australia has had a rich history in which there were the forerunner societies the Western Australian Natural History Society (1891-1898), the Mueller Botanic Society (1897-1903), the West Australian Natural History Society (which was incorporated with the Mueller Botanic Society, and the Natural History and Science Society of Western Australia (see Jenkins 1965, JRSWA 48: 33-44; Withers 1998, JRSWA 81:1-4). After receiving a Royal Charter from His Majesty through the Governor in 1913, the Society assumed its title as the Royal Society of Western Australia in 1914, and in 1937, it became incorporated.

SCHEDULE OF ORAL PRESENTATIONS

9.00 am	REGISTRATION and refreshments	
9.30	WELCOME	Dr Philip O'Brien, President, Royal Society of Western Australia
9.40	Jennifer Alexander	Lake Clifton: Thrombolites under stress
10.00	Michael Crone	Persistence of <i>Phytophthora cinnamomi</i> in nature
10.20	Mark W Langdon	Distribution, abundance and bioerosion of the grazing sea urchin <i>Echinometra mathaei</i> at Ningaloo Marine Park, Western Australia
10.40-11.10	MORNING TEA AND POSTER SESSION	
11.10	Alison Ritchie	The bird and the bees and the <i>Banksia</i> mating tress
11.30	Nadira Batool	Vanadium (IV) Complexes of Organic Acids in Aqueous Environment
11.50	Tegan Douglas	Quantifying basking behaviour of the Spotted Dove, <i>Streptopelia chinensis</i>
12.10	Lauren Rosser	High Nutritional Risk in children with Cystic Fibrosis
12.30	Amanda Page	Physiological plasticity of the Australian water rat (<i>Hydromys chrysogaster</i>)
12.50	BBQ LUNCH	
2.00	Charlotte Mack	Palynology and stratigraphy of the southern Officer Basin
2.20	Vineeta Bilgi	Mechanisms and Effects of Silencing Green Peach Aphid Genes via RNA
1.20	CLOSE	Dr Philip O'Brien, President of the Royal Society of WA

LIST OF POSTER PRESENTATIONS

PRESENTER	POSTER TITLE
Ganjar Saefurahman	Heterotrophic Growth of <i>Nannochloropsis</i> sp. using Cassava Hydrolysate Medium
Harshini Herath	Functional Analysis of Genes Encoding Trans-spliceosome Units of the Plant Parasitic Nematode <i>Pratylenchus thornei</i> by RNA Interference
Vanessa Boladeras	Preliminary investigation into the fish fauna of the Vasse-Wonnerup Wetland System

ABSTRACTS - ORAL PRESENTATIONS

JENNIFER ALEXANDER

Lake Clifton: Thrombolites under stress

Jennifer Alexander

Department of Environment and Agriculture, Curtin University

Lake Clifton is well known for the largest array of living thrombolites in the southern hemisphere. They were first described in the 1980s when the lake ranged in salinity between 7 and 35 ppt. Within the last 25 years the salinity in the lake has increased with levels ranging between 34 and 102.6 ppt. In 2002, 2005, 2007 and 2010 there was a massive break down of thick microbial mats from the bottom of the lake and floating in the lake. Since monitoring began in 2007, thrombolites were found to be smothered with *Cladophora* during spring and summer – a sign of eutrophication. The microbial community of Lake Clifton including those responsible for the growth of thrombolites, were investigated in conjunction with the environmental factors. The results indicate that the system has become eutrophic and hypersaline with thrombolites exhibiting a decline in species composition and health.

MICHAEL CRONE

Persistence of *Phytophthora cinnamomi* in nature: Presence of stromata, oospores, and chlamydospores and biotrophic growth in annual and herbaceous perennial plant species.

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Phytophthora cinnamomi can survive more than 50 years in the *Eucalyptus marginata* forest despite the death of susceptible species. We investigated whether the eradication of vegetation from black gravel sites reduced pathogen survival. After elimination of living plants pathogen recovery declined over 2 years compared to control sites. Annuals and herbaceous perennials were shown to be predominantly asymptomatic hosts responsible for the persistence of the pathogen. For the first time, a biotrophic or endophytic mode for this pathogen was shown by the presence of haustoria. Abundant stromata were shown for the first time; these germinated to produce numerous selfed oospores (300-400 per mm²) and thick-walled chlamydospores. This is the first report of viable oospores capable of germination and colony development being formed in a natural environment. The significance of these observations for *P. cinnamomi* control will be explored.

MARK W. LANGDON

Distribution, abundance and bioerosion of the grazing sea urchin *Echinometra mathaei* at Ningaloo Marine Park, Western Australia

Mark W Langdon^a, Mike van Keulen^a, Eric I. Pauling^b

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Sea urchins can have a significant influence upon the ecological structure of coral reefs through bioerosion of substrata and also by affecting competition for space. They are important grazers in many marine systems and can cause major ecosystem changes when their populations reach high levels (generally after a decline in the numbers of their fish predators). However, the relative importance of the role of sea urchins in influencing the composition and structure of coral reef habitats has rarely been explored. This study examined coral reef habitats and macroinvertebrate (particularly urchins) distribution and abundance within Ningaloo Marine Park (NMP). Field sampling was undertaken at over 100 sites within the park, focussing on near shore, lagoonal and back reef areas within Sanctuary zones and adjacent Recreation zones. Data analyses indicated that the distribution of urchins was not affected by the management zones of the park (i.e. no significant evidence was found of indirect effects from fishing of urchin predators). However, habitat type has a major influence on urchin distribution, e.g. urchin populations were higher on nearshore intertidal and sub-tidal reef platforms, lagoonal patch reefs and shallow backreef platforms than other habitats. In coral reefs in other parts of the world, unusually high urchin populations can indicate overfishing. This study found no indication of fishing pressure indirectly affecting urchin densities, which suggests that the current zoning may be effective and urchin abundances are likely to be a natural feature of the reef system. Urchin morphometrics and gut content analyses from different habitats in four regions of NMP indicated higher mean urchin densities, size and subsequent bioerosion rates in southern regions than in the north of NMP. Although bioerosion rates were found to be comparable to some studies of degraded (overfished) reef systems in other parts of the world, this does not appear to be the case at Ningaloo.

ALISON RITCHIE

The birds and the bees and the *Banksia* mating trees

Alison Ritchie, S. Krauss, P. Nevill, E. Sinclair, K. Dixon

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Australia and Science Directorate, Botanic Garden and Parks Authority*

The delivery of pollinator services is key to the functionality, self-sustainability and success of restored populations. The Southwest of Western Australia has the highest proportion of bird pollinated species and diversity of pollinators in the world. The importance of these pollinator guilds for outcrossing and production of genetically robust outbred seed in West Australian plant populations is known, however their implications for restoration success is rarely taken into account. To address these issues, pollination studies of *Banksia attenuata* and *Banksia menziesii*, two keystone tree species used in *Banksia* woodland restoration are being conducted. Pollination and mating systems of the summer flowering *B. attenuata* and winter flowering *B. menziesii* within post-mining restored populations are compared to natural fragmented and natural unfragmented populations. In this presentation I will focus on comparing and contrasting observed pollinator visitation rates, pollinator assemblages and foraging behaviour between the two *Banksia* species and between population types. An improved understanding of the association between plants and pollinators, interactions among fitness, genetic diversity and the similarity of these species will benefit restoration practitioners seeking to manage and restore these natural ecosystems.

NADIRA BATOOL

Vanadium (IV) Complexes of Organic Acids in Aqueous Environment

Nadira Batool, Danielle Meyrick, Peter May

School of Chemical and Mathematical Science, Murdoch University

Vanadium has significance in industrial, nutritional, physiological and environmental fields; hence its chemistry has attracted significant attention recently. Because of the physiological relevance of Vanadium

(IV), its complexation behavior with organic ligands is of great interest for a better understanding of the interactions with bimolecular entities. The chemical behavior of vanadium (IV) has been explored to a significant extent with respect to biological systems, while the aqueous, hydrometallurgical and environmental chemistry of vanadium (IV) is less well understood.

This study is addressed to highlight the main aspects of transport, fate and stability of vanadium species in aqueous, natural and processing environments. The chemical speciation of the vanadyl ion (VO^{2+}) and its complexes with some organic ligands (acetate, butyrate, formate, lactate, oxalate and propionate) in aqueous solution has been determined for the first time as a function of pH (1.60 – 9.00). The potentiometric techniques, computational analysis, ^{51}V NMR spectroscopy and UV/Visible spectroscopy at constant ionic strength ($I \approx 1 \text{ M NaCl}$) were employed for analysis. Data generated by this study can be used in thermodynamic models for reliably predicting the deportment of vanadium in a range of chemical environments.

TEGAN DOUGLAS

Quantifying basking behaviour of the Spotted Dove, *Streptopelia chinensis*

Tegan Douglas^a, Dr Christine Cooper^a, Prof Phil Withers^b, Prof Stephen J.J.F. Davies^a

^a*Curtin University*

^b*University of Western Australia*

Basking is a behavioural adaptation that reduces thermoregulatory energy expenditure by utilising available solar energy. Basking behaviour is observed across the diversity of Columbiformes, including the naturalised Spotted Dove *Streptopelia chinensis* in Australia. This study aimed to quantify the energetic savings achieved by basking *S. chinensis* under laboratory conditions and to explore the environmental conditions that encourage basking behaviour responses. A modified flow-through respirometry system was used to simulate an environmental regime that allowed birds to choose between cold ambient light and a warm radiant heat lamp. Results suggest that while basking does result in energy savings, doves held in captivity are not under sufficient energetic pressure to bask at every opportunity. Basking is also accompanied by a significant increase in evaporative water loss, so animals must trade off between energetic savings and water loss costs.

LAUREN ROSSER

High Nutritional Risk in children with Cystic Fibrosis

Lauren Rosser^a, David Bryant^a, Kelly Josh^b, Therese O'Sullivan^a, Philippa Lyons-Wall^a, Amanda Devine^a

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^b*Princess Margaret Hospital CAHS*

Nutritional status is correlated with lung health and disease severity in cystic fibrosis (CF) patients and is an independent predictor of mortality. CF patients may have impaired pancreatic and intestinal function resulting in malabsorption of fat soluble vitamins and reduced nutritional status. This study describes the CF population of Princess Margaret Hospital (PMH) in terms of nutrition risk, lung function and fat soluble vitamin status and examines the associations between these factors. A cross sectional, retrospective medical record audit of 162 children diagnosed with CF in WA and admitted to PMH was undertaken. Gender, age, height, weight, number of hospitalisations over 12 months, serum fat soluble vitamins levels, pancreatic and lung function and were collected. Patient nutritional risk was calculated based on BMI percentile and change in weight and categorised as High Risk, At Risk, Not At Risk. Chi square analysis and one-way ANOVA were used to determine the relationship between risk category and categorical variables (gender and pancreatic sufficiency) and continuous variables (lung function, age, fat soluble vitamins) respectively.

Preliminary results found patients classified At Nutrition Risk or High Nutrition Risk (29.4%) were more likely to be female (21%) than male (13%). Those with High Nutrition Risk or At Risk were more likely to have pancreatic insufficiency and reduced lung function when compared to those with No Nutritional Risk. There was no difference in levels of fat soluble vitamins between nutrition risk categories. These data confirm a positive correlation between nutrition risk, pancreatic insufficiency and reduced lung function in the WA CF population. Prevalence of nutrition risk was lower than anticipated but higher among females. Further exploration into the relationships between fat soluble vitamin status and other variables will be undertaken by the researchers over the next few weeks.

AMANDA PAGE

Physiological plasticity of the Australian water rat (*Hydromys chrysogaster*)

Amanda Page

Department of Environment and Agriculture, Curtin University

The water rat is a large semiaquatic rodent native to Australia and New Guinea. The species is found in a range of aquatic habitats, mostly in fresh water rivers and streams. The water rat also occurs in estuarine and marine habitats, where obtaining fresh drinking water is problematic. The ability of the water rat to persist in both marine and freshwater environments suggests the species possesses a flexible physiology in regards to water balance and osmoregulation. The aim of this research was to investigate the physiological plasticity of the water rat, by examining the metabolic and hygric physiology in response to salt water, urine concentrating ability, and kidney morphology. Results suggest that the water rat does not require a fresh water source for survival, obtaining sufficient moisture from its diet.

CHARLOTTE MACK

Palynology and stratigraphy of the southern Officer Basin

Charlotte Mack

Department of Applied Geology, Curtin University

The Narnoo Basin is a small intracratonic basin in the southwest region of the Officer Basin located adjacent to the northeast margin of the Yilgarn Craton. The basin is currently of significance in terms of geological exploration, with uranium, gold and heavy base metals already discovered. Due to the recent recognition of the Narnoo as a basin, and with little previous stratigraphic work completed, an informal stratigraphic system is being utilised for correlation, but this is proving inadequate as further drilling is completed. Located by Energy and Minerals Australia (EMA) within the Narnoo are the Mulga Rocks deposits, which are comprised of four separate zones of uranium mineralisation, associated with a palaeochannel. Palynological analysis of core recovered from these deposits will help to formalise the stratigraphic terminology in use by the current tenement owners, EMA. This analysis aims to resolve issues associated with the lateral continuity of units, the age of the basement rock intersected in multiple holes during historic and recent drilling programs and the significance of faulting across the Narnoo Basin.

This study will provide a foundation for the construction of a high-resolution spore-pollen framework for the Officer Basin and Western Australian Tertiary sediments that will be utilised by exploration industries and geological research. Comparison of the pollen and spore assemblages recovered from Narnoo Basin core with assemblages from the western Eucla and Bremer Basins will provide information as to the wider context of south-western Australian palaeovegetation. Relation of south-western palaeovegetation with studies completed in south-eastern Australian basins will allow for investigation of the evolution and differentiation of flora across southern Australia during the Tertiary, and its response to local and global environmental change that is important in today's changing environment.

VINEETA BILGI

Mechanism and Effects of Silencing Green Peach Aphid Genes via RNA Interference*

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

Plant Biotechnology Research Group, School of Biological Science & Biotechnology, Murdoch University

When chemicals are used to control insect pests the potential for resistant phenotypes to develop is well documented. Genetically modified plants expressing a bacterial protein (Bt) are now widely deployed, but are only effective against chewing insects. There is now an opportunity to exploit the highly conserved naturally occurring cellular process of RNA interference (RNAi) to silence specific genes in sucking insects such as aphids, before the mRNA is translated. RNAi can be triggered when double stranded RNA (dsRNA) is introduced into a cell: a series of cellular processes lead to unwinding of the RNA and binding to a complex which degrades a target mRNA with the same sequence, leading to loss-of-function of its protein.

In this project RNAi will be exploited as a control strategy for the green peach aphid, *Myzus persicae*, an important economic pest of many agricultural crops. Successful knockdown of vital genes of *M. persicae* using RNAi through dsRNA-transgenic host would provide an excellent method of control that is both economical and environmentally safe.

The research will make use of comparative bioinformatics to identify genes of *M. persicae* that are essential for feeding, survival, reproduction, development, and movement of the pest. We will use genomic resources of the best annotated multicellular organism to date, *Caenorhabditis elegans*, and information on expressed genes and genomic data available for the related pea aphid, *Acyrtosiphon pisum* as well as the EST database of *M. persicae* in the search for target genes. RNAi in aphids will be studied by feeding aphids on artificial diet sachets containing dsRNA homologous to target genes, and monitoring the effects on aphid survival, feeding and reproduction. Target genes that limit aphid reproduction will then be tested in host plants, where aphids will be fed on host plants engineered to express dsRNA of those genes.

**Supplementary information contained within poster presentation*

POSTER PRESENTATIONS

GANJAR SAEFURAHMAN

Heterotrophic Growth of *Nannochloropsis* sp. using Cassava Hydrolysate Medium

Ganjar Saefurahman^a, Mujizat Kawaroe^b

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^bSurfactant and Bioenergy Research Center Bogor Agricultural University Indonesia

Heterotrophic growth of *Nannochloropsis* sp. was studied in laboratory cultures with enrichment of cassava hydrolysate into culture medium as follows: (A) 25 ml *Nannochloropsis* sp., 75 ml seawater, without cassava hydrolysate; (B) 25 ml *Nannochloropsis* sp., 25 ml cassava hydrolysate, 50 ml seawater; (C) 25 ml *Nannochloropsis* sp., 50 ml cassava hydrolysate, 25 ml seawater. Cultivation conditions as follows: temperature 29°C, seawater pH 8, and salinity 30 ‰. Microalgae cultivation was performed at microalgae laboratory of Surfactant and Bioenergy Research Center using 100 ml Erlenmeyer covered by black plastic bags to prevent the influence of light. The specific growth rate of *Nannochloropsis* sp. was observed over 7 days. The highest density of microalgae was on the 4th day with 50 ml cassava hydrolysate (C treatment) about 172,661 cells/ml. The highest specific growth rate for *Nannochloropsis* sp. cultivation was observed on the 6th day without cassava hydrolysate (A treatment). Statistical analysis showed that different cassava hydrolysate feeding treatments in heterotrophically microalgae cultivation influenced the density of microalgae (cells/ml), but did not influence the specific growth rate of microalgae (/day).

HARSHINI HERATH

Functional Analysis of Genes Encoding Trans-spliceosome Units of the Plant Parasitic Nematode *Pratylenchus thornei* by RNA Interference

Harshini Herath, John Fosu-Nyarko, Michael G. K. Jones

Plant Biotechnology Research Group, School of Biological Science & Biotechnology, Murdoch University

Pratylenchus thornei is a root lesion nematode (RLN) that parasitises the cereals wheat and barley in Western Australia (WA). RLNs cause yield losses of 10-20% of wheat and barley in WA. Infection by RLNs results in necrotic lesions on host roots. *P. thornei* is a migratory endoparasite that remains mobile throughout its life cycle and feeds from host plant cells. Research on the genus *Pratylenchus* is not as extensive as that on root knot and cyst nematodes. Our research to develop robust control methods uses the natural cellular mechanism of gene silencing (RNA interference - RNAi) to inactivate trans-splicing of mRNAs in *P. thornei*. About 70% of mRNAs of the model nematode *Caenorhabditis elegans* are trans-spliced. Spliced leader (SL) trans-splicing is an mRNA processing mechanism present only in some lower eukaryotes like trypanosomes, rotifers, tunicates, crustaceans, flatworms, cnidarians, dinoflagellates and nematodes. It is important for operon processing in nematodes. SL trans-splicing is mediated by the trans-spliceosome which is composed of small nuclear RNA (snRNA) and proteins (small nuclear ribonucleoproteins/snRNPs) which are the targets of this research. RNAi is a regulatory mechanism that limits the transcript level of a gene by activating a sequence specific RNA degradation process. It is triggered by double stranded RNA (dsRNA). This mechanism can be triggered in plant parasitic nematodes either by ingestion of dsRNA with the help of a neurostimulant, or via *in planta* delivery. Comparative analysis of the transcriptome shotgun assembly of *P. thornei* with *C. elegans* has so far identified nine trans-spliceosome genes. *In vitro* RNAi experiments using these genes will be conducted with mixed stages of *P. thornei* in which the uptake of solution is traced with fluorescein isothiocyanate. Effects of gene silencing will be studied by examining the behaviour of nematodes and quantifying the extent of gene knockdown by quantitative real time PCR. Transgenic plants carrying vector constructs expressing dsRNA of each target gene will also be generated, infected with nematodes and the effect of gene silencing on the development,

movement, survival and reproduction of the nematodes assessed. This research will provide candidate genes for novel 'synthetic resistance' to plant parasitic nematodes. It is expected that this will reduce risks to the environment and human health compared with current chemical and some biological control methods. Effective control of nematode pests will contribute to increased and sustainable food production in the future.

VANESSA BOLADERAS

Preliminary investigation into the fish fauna of the Vasse-Wonnerup Wetland System

Vanessa M. Boladeras, Dr James R. Tweedley, Dr Stephen J. Beatty, A. Prof. Alan J. Lymbery,
Prof. Ian C. Potter

Murdoch University

The Vasse-Wonnerup wetland is an ecologically important area for birds and is listed as a 'Wetland of International Importance' by the Ramsar Convention. However, despite the regular algal blooms and fish kills almost no faunal research has been undertaken. Therefore, my project will investigate the spatial and temporal characteristics of the fish fauna of this system. The system has been divided into seven regions, each of which differ in their environmental characteristics, the Lower Vasse River Wetland (LVRW) remains entirely freshwater all year, while the Vasse and Wonnerup Estuaries fluctuate seasonally from freshwater to hypersaline and the Deadwater and Wonnerup Inlet remain marine. Fish sampling was undertaken in February and May 2012 (and will continue for a further year) using a 21.5 m long seine net. Species richness and density were the highest in the marine areas (Deadwater and Wonnerup) Inlet and lowest in the LVRW during both sampling periods. No species were recorded in the upper Vasse and Wonnerup estuaries. The fish fauna differed markedly among most regions, with the biggest differences occurring between the marine areas and the LVRW. The fish in the former regions were dominated by estuarine species, *i.e.* Elongate Hardyhead (*Atherinosoma elongata*), Black Bream (*Acanthopagrus butcheri*) and the Southern Longfin Goby (*Favonigobius lateralis*), the species with preference for oligohaline/fresh waters *i.e.* the Western Hardyhead (*Leptatherina wallacei*) and Swan River Goby (*Pseudogobius olorum*) dominated the LVRW. Two introduced species namely the Goldfish (*Carassius auratus*) and Eastern Gambusia (*Gambusia holbrooki*) were also captured.



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Compiled by Charlotte Mack and Lynne Milne