The Royal Society of Western Australia

RSWA Awards

Student Medallists 2011 (presented 2012)

The Royal Society of Western Australia Student Medal is awarded annually to graduating science students with an outstanding academic record from the universities in Western Australia. The students are nominated by their institutions.

The 2011 RSWA Student Medallists were given their presentations by our Vice Patron Professor Lyn Beazley at the RSWA Annual General Meeting at the Webb Lecture Theatre, University of Western Australia, on 16 July 2012. The Medallists are:-

Blake Wood - The University of Western Australia
Rylan Shearn - Edith Cowan University
Andrew Buckley - Curtin University
Wilfred Goh - Murdoch University
Anthony Egitto - The University of Notre Dame Australia

An account of the evening, together with a brief profile on the academic record of some of the Medallists, is contained in the RSWA Proceedings August 2012:-

http://www.rswa.org.au/publications/proceedings/2012%2008%20Proceedings.pdf

Extracts from the Proceedings are included on the following pages.

RSWA Awards: (left to right) Medallists Rylan Shearn (ECU), Blake Wood (UWA) and Andrew Buckley (Curtin), Professor Lyn Beazley, Dr Philip O'Brien and Dr Phillip Playford.

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Blake Wood - The University of Western Australia

Blake was the most outstanding Honours student in the Faculty of Natural and Agricultural Sciences at UWA. His Honours project investigated the potential interactions between non-mycorrhizal Proteaceae and arbuscular-mycorrhizal species that co-exist in Banksia woodlands. Members of the Proteaceae have been demonstrated through many experiments to be particularly proficient at extracting limited phosphorus reserves from the soil. This is largely due to cluster roots, unique root structures that release chemical compounds that solubilise and chelate phosphorus for plant uptake. Arbuscular-mycorrhizal (AM) species engage in fungal symbioses which benefit the plant in terms of water and nutrient uptake, however the ability to mobilise phosphorus to the same degree as non-mycorrhizal, cluster-rooted Proteaceae has not been demonstrated. Thus the experiment set out to quantify whether neighbouring AM plants could "scavenge" any phosphorus mobilised by cluster roots. This was done through a split-root design; with Banksia attenuata growing with an AM plant and the amount of cluster root production in the Banksia was to be manipulated by adding different levels of phosphorus to the root half of Banksia not in contact with the AM plant. The experiment was not able to demonstrate any clear facilitation of phosphorus by the Banksia for the neighbouring AM plant, and the case was more of competition for space between the two plants. The lack of clear findings may have been confounded by the luxury levels of phosphorus in both of the plants, due to seedlings being obtained from a nursery with fertilised potting mix. Whilst in other studies where adding phosphorus decreased the amount of cluster root production, in Blake's experiment adding more phosphorus to Banksia attenuata did not decrease the levels of cluster root production; cluster root production was only decreased at the point where the level of phosphorus supply was toxic.

Since completing his Honours project Blake has been employed at Astron Environmental Services' "Plant Water Ecology" Business Unit, which focuses on monitoring the health of groundwater dependant vegetation on minesites in the Pilbara, where dewatering is occurring to gain access to the ore bodies. This work involves a lot of physiological measurements that he was exposed to during his undergraduate degree and work with the School of Plant Biology at UWA. In the future he hopes to reach a senior scientist role at Astron, and potentially complete a Ph.D. involving some of the research he does with Astron on Plant Water Ecology.

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Rylan Shearn - Edith Cowan University

Rylan completed a B.Sc. (Marine & Freshwater Science) with Honours in Biological Sciences. His supervisor reported that he is an outstanding student who achieved an excellent first class Honours and that he has been consistently in the top achieving students throughout his undergraduate studies. Rylan's Honours project was entitled 'Evolution and diversity of Bennelongia (Crustacea, Ostracoda) in Australia'. The project has been presented at the 4th International Barcode of Life Meeting in Adelaide and the 10th Invertebrate Biodiversity and Conservation Conference in 2011. Currently two manuscripts are in press from this work, the first will describe several new species, including one cryptic species and the second will test the east-west radiation hypothesis.

Rylan is currently finalising descriptions for three new species of mussel shrimp, which was one component of his honours degree results. He has now begun a Ph.D. and in this study he hopes to provide a better understanding of Geographic Parthenogenesis in Australia using mussel shrimp as a model organism.

Rylan Shearn explaining his project to Professor Lyn Beazley

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Andrew Buckley - Curtin University

Andrew's Honours project was titled 'Density Functional Theory Calculations of Magnesium Hydride: A Comparison of Bulk and Nanoparticle Thermodynamics'.

Synopsis of project: The thermodynamics of nanoparticulate magnesium hydride have been experimentally shown to desorb hydrogen at a lower temperature than the bulk material, and this project sought to reproduce this trend through Density Functional Theory simulations. Using a model known as the harmonic approximation, enthalpies and entropies of magnesium, and magnesium hydride nanoparticles were calculated and compared to their bulk counterparts, over a large temperature range. A natural extension of theoretical simulations already in the literature, this approach was still unable to reproduce the trend experimentally observed, and in fact, predicted an increased desorption temperature for nanoparticles. The results reveal a great deal about the strengths and shortcomings of the model used to describe the vibrational spectra, highlighting the strong implications of anharmonic effects in the "real-world". Reporting inaugural data for calculated entropies of magnesium and magnesium hydride nanoparticles, the study has been submitted for publication in the Journal of Physical Chemistry.

Andrew is now doing a Ph.D. at Curtin University with Associate Professor Nigel Marks and Professor Julian Gale. The broad topic is treating hydrogen as a quantum-particle within computational chemistry simulations on materials relevant to the hydrogen-economy. In particular, he is looking at the anharmonicity of hydrogen vibrations in MgH2 and quantum-proton calculations of diffusion in proton-conducting solid oxide fuel cells.

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Wilfred Goh - Murdoch University

I am currently doing my honours in Biomedical Science at Murdoch University. My project involves the conditioning of B cells in vitro, where naive B cells are cultured with different signals molecules (i.e. cytokines) to generate IgA secreting plasma cells. By determining the extent of naive B cell activation and subsequent differentiation into IgA secreting plasma cells, I hope to determine the combination of activating signals that would optimally generate IgA secreting plasma cells in culture. In addition I will also assess the activated cells for expression of homing receptors that facilitate trafficking to specific tissues. I hope the preliminary findings from my project would reveal insights to the generation of antigen specific IgA plasma cells that would migrate specifically to the lungs and provide immune protection against respiratory pathogens. With regards to what I hope to do in the future, I would love to be able to pursue a doctoral degree, after a short break upon completion of honours.

For further details on the outstanding work of Wilfred Goh, refer on the following 2 pages to letter 25 June 2012 from Professor Bev Thiele, Deputy Vice Chancellor Academic, Murdoch University.

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Murdoch UNIVERSITY

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25TH June 2012

Dear Dr Milne

I write in response to your letter of 8th June 2012, seeking the nomination of an eligible Science student from Murdoch University for The Royal Society of Western Australia Student Medal, 2011.

Murdoch University would like to nominate Wilford Goh. Wilford has an outstanding academic record at Murdoch University, obtaining High Distinction grades in each of his undergraduate units, in his Forensic Biology/Biomedical Science Degree. Prizes he has received include: The Vice-Chancellors Commendation for Academic Excellence in each of the academic years he has completed; 2010 Murdoch University Medal for academic excellence; School of Veterinary and Biomedical Sciences Student Research Scholarship Summer 2009-2010.

The Summer Research Scholarship resulted in 6-weeks conducting a research project on the Damaraland mole rat vomeronasal organ. Damaraland mole rats, endemic to South Africa, are remarkable because they are eusocial, with only 1 female and 1-3 males in a colony reproductively active. The vomeronasal organ is postulated to be involved pheromonal signaling that helps to maintain this uncommon social organization. At every stage of the research project, from his excellent laboratory work though to the professionalism of his final report, Wilford left his supervisors astounded by his productivity and the quality of his scientific research skills. As a result of his achievements, Wil was employed as a research assistant in the School of Veterinary & Biomedical Sciences on a casual basis to continue the research project in parallel with his undergraduate studies. Through this work, Wilford has helped to advance our understanding of what is arguably the most unusual mammalian social organisation.

Wilford's aptitude for scientific research was recognized among the wider Western Australian research community in August 2010, when he presented these findings at the Endocrine and Reproductive Sciences Symposium and was awarded second prize in the Student Oral Presentation category (in competition with students undertaking higher, doctoral qualifications). In summer 2010-2011, Wilford was awarded and successfully completed a Summer Scholarship from the Australian National University, recognition that his scientific achievements are competitive at a national level. Through these achievements, Wilford has made a very significant contribution to biological research in Australia, across a range of fields. This consistent engagement and achievement in scientific research is quite remarkable for a scientist who is still 6 months from completing his undergraduate Honours degree.

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Wil's Biomedical Science Honours Project is Titled: *Conditioning B cells for antibody production at mucosal surfaces – in vitro generation of antibody-screening B cells.*

Project Description: Respiratory mucosal surfaces are the major site of entry for airborne pathogens and allergens, and antibodies produced by B cells of the immune system provide a major source of immune protection at this site. Several types of antibodies (immunoglobulins) can be made by B cells, of which immunoglobulin A (IgA) is most important of these for protection of mucosal surfaces. Recently, the conditions required for the artificial generation of IgA-secreting B cells *in vitro* in humans were described, including expression of mucosal homing-receptors required to guide the IgA-B cells to mucosal surfaces. This raises the possibility that B cells can be conditioned for IgA production against a pathogen or allergen of choice and targeted to a mucosal surface to provide protection.

In this project, we wish to extend these human studies into the mouse, where we can more easily examine the potential of this approach for generating IgA-secreting B cells that can provide protection against respiratory viruses such as influenza virus and aeroallergens that induce asthma *in vivo*. In this first-phase project, B cells will purified from the spleens of normal mice and the *in vitro* conditions established for differentiating these cells into IgA-secreting B cells and expression of mucosal homing receptors. With further refinement, this approach raises the exciting possibility of generating large numbers of B cells producing IgA of defined specificity at mucosal surfaces, with the capacity to protect against a wide variety of respiratory inflammatory diseases.

Murdoch is extremely proud of Wilford's outstanding academic achievements and with his dedication and contributions to research and takes pleasure in nominating him for this prestigious award.

Yours sincerely

Professor Bev Thiele
Deputy Vice Chancellor Academic

The Royal Society of Western Australia

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Anthony Egitto - The University of Notre Dame Australia

Anthony graduated in December 2011 from the University of Notre Dame Australia with the double degree, Bachelor of Science / Bachelor of Behavioural Science, which included a major in Environmental Science. During the course of his degree Anthony completed 32 units of which 26 were at Distinction and High Distinction level.