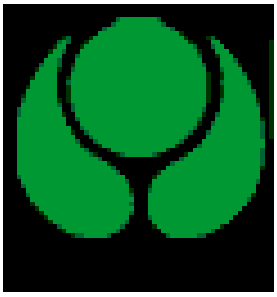

PHYTOGEN

A
NEWSLETTER
FOR
AUSTRALIAN
PLANT SCIENTISTS

Volume 10 Number 1
May 2008

PHYTOGEN

Volume 10: Number 1

INSIDE THIS ISSUE

A big thanks to all the scientists who contributed to this issue of Phytogen.

Editor's corner

Dear Fellow Society Members,

Thank you for all of your contributions, as we again have another excellent issue of Phytogen. The "state of affairs" collated by the Western Australian representative Patrick Finnegan highlights some of the research occurring in plant sciences in Western Australia (see page 12).

This year ASPS turns 50. For a foretaste of some details of planned events to celebrate this momentous occasion see page 10.

The annual meeting of the Society, ComBio, will be held in Canberra this year. It looks to be a very exciting meeting with many local and international speakers in the plant sciences. I highly recommend attending ComBio meetings as they are a place to get a taste in what is happening in plant sciences (and life sciences in general) around the country (not to mention the opportunity to catch up with friends and make new friends interested in the biological sciences). The focus of each organising committee is always slightly different. This year this is especially true as ASPS will be celebrating its JUBILEE. There is still time to register for this exciting meeting. For further details see page 8 and 10.

Please keep the articles coming as it is your contributions that make Phytogen a success. A two year roster is in place for the "State of Affairs" and **New South Wales** will feature in the next issue. Reports from local, national and international meetings relevant to plant science are welcomed; so please send reports to Andy Netting (anetting@unsw.edu.au) who is co-ordinating "From our Seed Banks".

Helen Irving

URGENT CALL for Reports on Meetings

We are always on the look out for reports on the conferences that our members attend. This is an opportunity to write about research that excites you and share your interests with our members.

Please send meeting reports to: reports to Andy Netting (anetting@unsw.edu.au)

ASPS Teaching Award 2008

The Australian Society of Plant Scientists seeks to recognize the many excellent teachers of tertiary level Plant Biology within our membership, and to reward the finest of these with the annual ASPS Teaching Award. The Teaching Award has over the years attracted a large number of nominations from highly skilled and motivated teachers of plant science, who are recognized by the society for their leadership in the development of new teaching programs in plant science and their contribution to student learning.

The ASPS Teaching Award will be made to the nominee who most successfully demonstrates 'excellence, innovation and/or contributions to teaching plant science at university level'. The Society recognizes that teaching spans a broad range of activities, from the increasingly sophisticated uses of online delivery, interactive texts, community engagement and student-centred learning approaches, to name but a few, to more traditional approaches based ultimately upon the excellent communication skills and charisma of the teachers involved. All forms of teaching activity are equally eligible for the award. The award is open to nominations from individuals, and teams.

In keeping with the Society's aims of 'Working on behalf of members … to educate others in plant sciences', the recipient of the ASPS Teaching Award is invited to speak at the ComBio conference, to present the ideas and innovations behind their teaching. In 2008, this lecture will form a key part of Education Symposium B, scheduled for 1245-1415 on Wednesday September 24.

In this, the fiftieth year of the Society's existence, the Council of ASPS anticipates a strong field of contenders for the Teaching Award. We encourage you to submit your nominations to the Hon. Secretary by the revised closing date of May 30 2008.

The nomination form can be found on the Society's web pages, http://www.asps.org.au/awards/teaching/

Chris Ford
ASPS Council Representative
Plant Science Education

David Day
President

DISCIPLINE AND STATE PERSPECTIVES

Education

Gynoecium structure tutorial web site

Previously I had noted that my botany and plant identification students could not confidently determine if leaves were alternate/opposite/whorled or if leaves were compound what level of division they displayed (e.g. trifoliolate/pinnate/palmate/etc). I devised a tutorial (http://www.csu.edu.au/herbarium/HRT202/intro/intro.htm) based on numerous scans of living material for each feature, complemented with an interactive ToolBook-based test. This web site has been well received by a wide range of students and evaluations have shown it is particularly useful for distance education students and as a pre- and post-practical exercise for fulltime students.

Possibly from a student's perspective the most problematic part of floral structure (and thus keying plants out) is the gynoecium. Determining whether the ovary is superior/inferior or whether the carpels are free/fused or assessing the number of carpels can cause considerable confusion. Part of the problem, for both students and teachers, is that the floral parts are often very small and for many months of the year the number of samples available to show the diversity of structure is limited. With the help of Kylie Kent (web page design) and Scott Black (ToolBook based tests) I have developed another tutorial and test, this time on gynoecium structure.

See: http://www.csu.edu.au/herbarium/HRT202/Gynoecium/intro.htm

Obtaining images for the leaf morphology tutorial was relatively simple as shoots and leaves could be quickly collected and scanned. The gynoecium tutorial required transverse and longitudinal sections of flowers to be prepared and then photographed using a dissecting microscope. Approximately 50 species were used in constructing the tutorial and another 12 species were used in the test. The species are a mix of Australian natives and crop, weed and garden species that have been introduced into Australia.

I have not seen anything of direct equivalence on the www but wouldn't be surprised if there is. If this is the case hopefully the additional examples will be useful. We would welcome feedback on the tutorial and tests – from factual faults, layout improvements, the inability to run some or all of the tutorial or tests on some computers, etc.

Geoff Burrows
Charles Sturt University
gburrows@csu.edu.au

ComBio 2008 Satellite Symposium
Boden Conference

Plant Energy and Water Productivity

from genes to environment

The impacts of global climate change and drought on the environment and agriculture, coupled with the need to increase the supply of food and bio-energy for a growing world population, provides plant scientists with a major challenge.

The aim of the symposium is to bring together a diverse group of scientists to consider future strategies necessary to develop improved plants for agriculture and biofuel production and the performance of plants in natural environments.

International Speakers:

Sarah Assmann	Pennsylvania State Uni. USA
Frank Hochholdinger	Uni. of Tübingen Germany
Robert E Sharp	Uni. of Missouri Columbia USA
Sally Wilkinson	Lancaster Uni. UK
Ralf Kaldenhoff	Darmstadt Uni. of Tech. Germany
Michael Nuccio	Syngenta USA
Christoph Peterhansel	RWTH Aachen Germany
Tim Caspar	Dupont USA
Phil Mullineaux	Uni. of Essex UK
Asa Strand	Umea Plant Sciences Centre Sweden
Andreas Weber	Heinrich Heine Uni. Germany
Dean DellaPenna	Michigan State Uni. USA
Steve Long	Uni. of Illinois USA
Tom Sharkey	Michigan State Uni. USA
Per Gardestrom	Umea Plant Sciences Centre Sweden
Vaughan Hurry	Umea Plant Sciences Centre Sweden
Rob Last	Michigan State Uni. USA

Australian Speakers:

Peter Franks	James Cook Uni. Cairns.
Susanne von Caemmerer	Australian National Uni. Canberra
Josette Masle	Australian National Uni. Canberra
Brian Loveys	CSIRO Plant Industry Urrbrae
Steve D Tyerman	Uni. of Adelaide Glen Osmond
Rudy Dolferus	CSIRO Plant Industry Canberra
Linda Tabe	CSIRO Plant Industry Canberra
Murray Badger	Australian National Uni. Canberra
Spencer Whitney	Australian National Uni. Canberra
Barry Pogson	Australian National Uni. Canberra
Jim Whelan	Uni. of Western Australia Perth
Steve Smith	Uni. of Western Australia Perth
Ben Hankamer	Uni. of Queensland Brisbane
Warwick Hillier	Australian National Uni. Canberra
Harvey Millar	Uni. of Western Australia Perth
Ian Small	Uni. of Western Australia Perth

Thursday 18th – Saturday 20th September 2008

Robertson Lecture Theatre, Australian National University Canberra

DAY 1: WATER PRODUCTIVITY:
- Control of transpiration.
- Roots and hormone signalling.
- Roots and hydraulic signalling.
- Drought stress and reproductive development.

DAY 2: PLANT ENERGY:
- Enhancing CO_2 uptake efficiency.
- Light and oxidative stress tolerance.
- Organelle biogenesis.
- Organelle metabolism.

DAY 3: PLANT PRODUCTS AND BIO-FUELS:
- From artificial photosynthesis to bio-fuel production.
- Respiration, photosynthesis and stress tolerance.
- Genomic approaches to future improvements.

Conference Website:
www.plantenergy.uwa.edu.au/webpages/conferences/index.html
www.csiro.au/events/CropBio2008-symp

Joint Organizers:

plant energy biology
ARC Centre of Excellence

Assoc. Professor Barry Pogson
School of Biochemistry and Molecular Biology
The Australian National University, ACT 0200
Telephone: (02) 61255629
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ComBio2008

ANU

ASPS

Australian Academy of Science

COMBIO 2008

Plant Sciences in Canberra, September 2008: COMBIO and much, much more

There will be two major conferences for plant scientists September 18th to 25th in Canberra with over 20 international speakers and 60-70 national speakers. It will also be the 50th anniversary of our society, The Australian Society of Plant Scientists. So make your plans now to come to Canberra.

COMBIO Satellite and Boden Conference on Plant Energy and Water Productivity: from genes to environment, September 18-20th

- 18 International and 18 National speakers covering hormone signalling, transpiration, photosynthesis, drought and oxidative stress signaling, organelle biogenesis and metabolism, artificial photosynthesis, biofuels, genomics and global climate change.
- The aim of the symposium is to bring together scientists to assess the future strategies necessary to develop improved plants for agriculture and bio-fuel production and to assess plants in natural environments.
- We thank our sponsors, including ARC Centre of Excellence in Plant Energy Biology, CSIRO, Australian Academy of Science, COMBIO and ASPS.

COMBIO, September 21-25th.

ComBio2008
National Convention Centre Canberra
21-25 September 2008

- A dedicated Plant Sciences Stream with over 50 speakers, plus, symposia on plant biology in the other cellular and biochemical streams.
- Plants from Genes to Geoscience. An extra plant stream for 1 day on ecophysiology and plant ecology sponsored by ARC Research Network for Vegetation Function (http://www.vegfunction.net/index.html)

- ASPS Celebration of 50 years. Make sure you attend this special and unique event in the history of our society. More details are provided in this issue of Phytogen or via Paul Kriedemann kriedemann@rsbs.anu.edu.au
- Early Career Scientists. This year we have increased the number of talks per symposia to enable 2 talks to be chosen from abstracts and preference will be given to early career scientists (PhDs and postdocs). We will also be running a Careers Development Workshop.

More information on the meetings are provided within this issue of Phytogen and on the Conference Websites: http://www.asbmb.org.au/combio2008/index.html and http://www.plantenergy.uwa.edu.au/webpages/conferences/index.html or www.csiro.au/events/CropBio2008-symp

See you in Canberra,

Barry Pogson (barry.pogson@anu.edu.au), Frank Gubler and Rudy Dolferus
On behalf of the COMBIO Organising Committee and the Plant Energy and Water Productivity Organising Committee.

ASPS Jubilee celebrations - an invitation for contributions

Memorandum to ASPS membership

As members of ASPS will be aware, our Society 'turns 50' in August 2008, and this significant milestone will be celebrated during the course of ComBio 2008 in Canberra. Incoming President Rana Munns has entered into arrangements to hold formalities at CSIRO Discovery Centre on the evening of Tuesday 23 September 2008, and full details for that occasion will be outlined in due course.

One item on the agenda will be a retrospective view of participants at the inaugural meeting in Adelaide on 19 August 1958, and a list of those delegates is shown below.

As a tribute those participants, Martin Canny and Paul Kriedemann (both based at ANU Research School of Biological Sciences, Canberra) are putting together a PowerPoint presentation to show to members who come to the Jubilee celebrations on 23 September. To that end, they are especially keen to obtain photographs of the original participants, plus any related anecdotal material for their presentation. Anything at all that relates to our inaugural meeting will help them capture the mood of that occasion 50 years ago.

If you have images or records in hard copy that you are prepared to share, please post them to Paul Kriedemann, Environmental Biology Group, Research School of Biological Sciences, ANU, GPO Box 475 Canberra ACT 2601. Such items will be scanned, and originals returned promptly. Alternatively, if you have images that are already in digital format, please dispatch those files as email attachments to paul.kriedemann@anu.edu.au

Thanks to certain retirees in ASPS, and former affiliates of ASPP, Martin and Paul have already secured some material for their PowerPoint presentation; so the process is underway, and gaining momentum! Obviously, members who have already furnished photographs will be aware of those submissions, and are not expected to respond further.

Reflecting on the original membership of ASPP, as summarised in this present article, particular individuals who had a formative influence on directions of plant science in Australia over the past 50 years can be identified. Indeed, there are delegates on that list who, arguably, instigated new and specialised fields of inquiry. Martin and Paul would be especially appreciative of member essays on such topics, and look forward to 'hearing' from you.

Dr Paul E Kriedemann
Adjunct Professor - Environmental Biology RSBS ANU
GPO Box 475 Canberra ACT 2601
paul.kriedemann@anu.edu.au

ASPP INAUGURAL MEETING 19 August 1958

R J Kirkland Biochemistry Dept, University of Sydney
J Dainty Biophysics Dept, University of Edinburgh
T F Neales Botany Dept, Melbourne University
B B Carrodus Botany Dept, University of Adelaide
E M Gates Botany Dept, University of Adelaide
Harold Woolhouse Botany Dept, University of Adelaide
J P Riches Botany Dept, University of Adelaide
John I Hawker Botany Dept, University of Adelaide
Leonie Sherwood Botany Dept, University of Adelaide
M E Tuckman Botany Dept, University of Adelaide
P J Brownell Botany Dept, University of Adelaide
R L Specht Botany Dept, University of Adelaide
A J McComb Botany Dept, University of Melbourne
D J Carr Botany Dept, University of Melbourne
J T Wickich Botany Dept, University of Sydney
D M Paton Botany Dept, University of Tasmania
F J F Fisher Botany Dept, University of Tasmania
R J Grieve Botany Dept, University of Western Australia
JS Turner Botany School University of Melbourne
D F Gaff Botany School, University of Melbourne
R S Vickery Botany School, University of Sydney
D H Turner CSIRO Botany Dept, University of Sydney

M D Hatch CSIRO Botany Dept., University of Sydney
K S Rowan CSIRO Botany School, University of Melbourne
C A Appleby CSIRO Div of Plant Industry, Canberra
D S Riceman CSIRO Div. of Biochem & Gen Nutrition, Adelaide
G B Jones CSIRO Div. of Biochem & Gen Nutrition, Adelaide
J Bain CSIRO Div. of Food Preservation, Homebush NSW
J D McLean CSIRO Div. of Industrial Chemistry, Box 433 GPO, Melbourne
M P Hegarty CSIRO Div. of Plant Industry, Brisbane
A E Grant Lipp CSIRO Div. of Plant Industry, Canberra
A Walker CSIRO Div. of Plant Industry, Canberra
J E Falk CSIRO Div. of Plant Industry, Canberra
J Phillips CSIRO Div. of Plant Industry, Canberra
N G Slater CSIRO Div. of Plant Industry, Canberra
N P Kefford CSIRO Div. of Plant Industry, Canberra
P L Goldacre CSIRO Div. of Plant Industry, Canberra
P R Whitfeld CSIRO Div. of Plant Industry, Canberra
R E Williams CSIRO Div. of Plant Industry, Canberra
L T Evans CSIRO Division of Plant Industry, Canberra
H Groenewegen CSIRO Irrigation Research Station, Griffith NSW
John S Pate CSIRO Plant Physiology Unit, Botany School, Sydney University
A B Hope CSIRO Plant Physiology Unit, Botany School, Sydney University
D Adamson CSIRO Plant Physiology Unit, Botany School, Sydney University
H. Adamson CSIRO Plant Physiology Unit, Botany School, Sydney University
J F Turner CSIRO Plant Physiology Unit, Botany School, Sydney University
R N Robertson CSIRO Plant Physiology Unit, Botany School, Sydney University
T C Chambers CSIRO Plant Physiology Unit, Botany School, Sydney University
L H Thomas CSIRO, Applethorpe, Qld
C T Gates CSIRO, Griffith, NSW
N K Boardman CSIRO, PO Box 109, Canberra
G K Sutherland CSR Co Ltd, Research Dept, Sydney
J B Davenport CSURI Div of Food Preservation, Homebush NSW
G A Atkins Defence Standards Labs, Dept of Supply, Melbourne
R K Morton Dept of Ag. Chemistry, Waite Institute, Adelaide
J G Wood Dept of Botany, University of Adelaide
L H May Dept of Plant Physiology, Waite Institute, Adelaide
B McGlasson Dept. of Agriculture, South Australia
M B Spurling Dept. of Agriculture, South Australia
G R Edwards Dept. of Plant Physiology, Waite Institute, Adelaide
M J Canny ICIANZ Central Research Laboratory, Melbourne
B A Palk Waite Institute, Adelaide
D Aspinall Waite Institute, Adelaide
L Paleg Waite Institute, Adelaide
N G Ma Waite Institute, Adelaide
J Melville Waite Institute, P B Adelaide

Focusing on one state's research per edition

This edition:

Western Australia

Collated by Patrick Finnegan
(the Council representative resident in Western Australia)

The following feature highlights some of the current plant science related research activities in Western Australia. It was compiled from contributions by those ASPS members, who responded to the call, and therefore only covers selected activities and workgroups.

Australian Centre for Necrotrophic Fungal Pathogens Murdoch University

Contributed by P. Solomon (P.Solomon@murdoch.edu.au)

The Australian Centre for Necrotrophic Fungal Pathogens (ACNFP) was established at Murdoch University as a research centre in 2000 (funded by the Grains Research and Development Corporation). The aim of the ACNFP is to undertake fundamental research into the mechanisms of pathogenicity and resistance in necrotrophic fungal pathosystems. Some of our current projects are listed below.

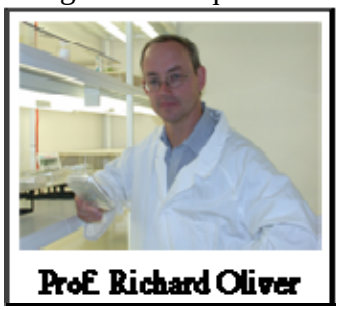
Stagonospora nodorum-*wheat interaction*

Dr. Peter S. Solomon, Dr. Margo Ferguson-Hunt, Dr. Kar-Chun Tan, Kasia Rybak, Maryn Lord, Ormonde Waters, Simon IpCho, Joel Gummer, Christian Krill and Prof. Richard P. Oliver


Dr. Peter Solomon

The "stago" group within the ACNFP is focused on understanding the molecular interaction between the fungus *Stagonospora nodorum* and wheat. *S. nodorum* is the causal agent of leaf and glume blotch on wheat and is responsible for significant yield losses, particularly in Western Australia. We have made significant progress towards identifying the key facets of the disease which will promote better control strategies. The "stago" group is exploiting many of the latest technologies including genomics, transcriptomics, proteomics and metabolomics. Each of these approaches provides a unique insight into the disease highlighting the strengths and weaknesses of *S. nodorum* as a pathogen.

One project within the "stago" group that has recently attracted attention was the finding that *S. nodorum* secretes proteinaceous host specific toxins. This study gathered momentum when the genome sequence of *S. nodorum*, funded by the Grains Research and Development Corporation, was completed in 2005 and recently published in *Plant Cell*. The sequence provides a wealth of information highlighting what makes *S. nodorum* such a successful pathogen. Already the sequence has already revealed one of *S. nodorum*'s hidden secrets. One of the most interesting findings when first analysing the genome sequence was identifying a gene almost identical to *ToxA* from another pathogen, *Pyrenophora tritici-repentis*. The *ToxA* gene from *P. tritici-repentis* controls specificity of the interaction with its host, wheat. Host genotypes carrying dominant alleles of *Tsn1* are susceptible to isolates of the pathogen expressing *ToxA*. Isolates of *P. tritici-repentis* lacking *ToxA* cause significantly reduced symptoms on lines containing *Tsn1*. The almost identical gene in *S. nodorum*, named *SnToxA* was subsequently characterised. *SnToxA* was expressed especially during early infection of wheat. Disruption of *SnToxA* by gene replacement resulted in strains that produced significantly reduced disease on wheat lines carrying *Tsn1*.



Whilst we had now determined that *SnToxA* had a required role for infection, it was the identity that the genes from *S. nodorum* and *P. tritici-repentis* shared that was striking. In fact, these genes are 99.3% identical at the nucleotide level, far beyond that expected for conserved genes in related species. To better understand this shared identity so with the help of collaborators in North Dakota and Zurich, we sequenced the *ToxA* genes from a world wide collection of isolates of *P. tritici-repentis* and *S. nodorum*. The *P. tritici-repentis* sequences were found to be identical to each other and very similar to the *SnToxA* sequence present in a West Australian isolate of *S. nodorum*. The *S. nodorum* sequences were highly variable and showed an excess of non-synonymous codon changes over synonymous, suggesting diversifying selection. In addition to *ToxA*, the transposase gene and flanking sequence comprising approximately 10.25 kb was present in *P. tritici-repentis*. These findings suggest that the *ToxA* has recently been horizontally transferred from *S. nodorum* to *P. tritici-repentis* resulting in the evolution of significantly more virulent of the pathogen. This study was published in *Nature Genetics* and follow up studies are underway.

Comparative genomics in crop legumes

Dr. Simon Ellwood, Dr. Huyen Phan, Nola D'Souza and Prof. Richard Oliver.

High value but relatively small scale crops, in particular legumes, usually have little existing genomic or EST information. Previous genetic maps have therefore tended to deploy anonymous markers, and are focused on selected lines and traits in a given agricultural context. To overcome this, we have created gene-based orthologous markers based on *Medicago truncatula*. Orthologous markers allow informed analysis and breeding and are transferable between distantly related species.

To make cross-species markers, we compared ESTs from the phylogenetically distant *M. truncatula*, *Lupinus albus*, and *Glycine max* species among the Papilionoideae to produce >600 intron-targeted amplified polymorphic markers (ITAPs). In addition, 126 *M. truncatula* cross-species markers from Department of Plant Pathology, University of California (USA), and a variety of species-specific markers were included. These markers have been used to generate a suit of comparative genetic maps of lentil (*Lens culinaris*), narrow-leafed lupin (*L. angustifolius*), and white lupin (*Lupinus albus*), broad bean (*Vicia faba*), lucerne (*M. sativa*), and chickpea (*Cicer arietinum*). These comparative maps have helped explain differences in

legume genomes through chromosomal rearrangements and genome duplications, and have also enabled some 20 traits of agricultural interest to be placed in syntenic contexts. We now plan to harness next generation sequencing platforms to create dense codominant marker maps and isolate such genes via positional cloning through identification of tightly linked markers, or identification of possible candidate gene(s) for a trait. This research was supported by NSW DPI and the ARC, and is in collaboration with Rebecca Ford at UM, Anna Torres (IFAPA, Spain) and the EU-GLIP program.

Genetic basis of resistance to Phoma medicaginis

Dr Simon Ellwood, Lars Kamphuis, Julie Lawrence and Prof Richard Oliver

The genetic basis of plant resistance to fungal necrotrophs is incomplete and has been characterised in relatively few pathosystems. As a disease model, this group is investigating the response of *Medicago truncatula* to *Phoma medicaginis*. *P. medicaginis* causes disease in lucerne (*M. sativa*) and may be considered a classical necrotroph as it lies within the subclass Pleosporales, a group of fungi that contains all known a necrotrophs, and within the Ascochyta / Didymella / Phoma complex that causes the most significant diseases in legumes.

We have found significant QTLs for resistance in each of two populations derived from crosses between a resistant accession and two different susceptible accessions. Both loci are recessive in nature, and the simplest explanation for the existence of two separate QTLs is that host genotype-specific susceptibility loci interact with *P. medicaginis* moieties or phytotoxins. Together with fine mapping, transcriptomics, metabolomics and disrupted resistance signalling pathway mutants are being investigated to further characterise resistance. This research is funded by the GRDC in collaboration with Dr. Karam Singh (CSIRO).

Resistance to microbes and pests in legumes

Dr Judith Lichtenzveig[1,2] Dr Karam Singh[2] and Prof Richard Oliver[1]
[1]ACNFP & [2]Biotech lab CSIRO

Researchers at the ACNFP and CSIRO are engaged in common and separate projects in order to decipher the mechanisms of legume resistance to pests and diseases.

"Dissecting the genetics of whatever comes in hand" (left to right: Stephanie, Joel, Jonathan and Judith)

The Medicago-necrotrophs project is a collaborative enterprise led by Richard Oliver (ACNFP) and Karam Singh (CSIRO). The project is funded by GRDC and aims at dissecting the genes involved in resistance to various species of necrotrophic fungi using *Medicago truncatula*, a model plant that is phylogenetically related to the most important legume crops (pea, faba bean, chickpea, lentils, lucerne and clover). Within this project, Dr Anderson[2] and Dr Lichtenzveig, assisted by Mr Brown[1] and Ms Lawrence[2], are leading the investigation on resistance to soil-borne pathogens: the recalcitrant *R. solani*, causal agent of seedling damping of and root rot in various crops, for which little or no natural resistance has been found; *Fusarium oxysporum*, causal agent of wilts in several field and horticultural crops; and *Phytophthora medicaginis*, an oomycete targeted by Mrs D'Souza[1,2] as part of her PhD project (MU - GRDC scholarship).

Several techniques are being applied in this study: classical and quantitative genetic approaches to analyse the genetic basis of the resistance response, histological evaluations of

the host-pathogen interaction using pathogenic isolates transformed with reporter genes, and molecular approaches such as transcription profiling, analysis of mutants with disrupted signalling pathways for their resistance response, transient and stable transformations. We are particularly interested in investigating the role of secondary metabolites in resistance – this investigation is carried out by Ms Williams as part of her PhD project (MU - GRDC scholarship).

Tanveer Khan (left) & Richard Oliver

At the ACNFP, Prof Richard Oliver and Dr Lichtenzveig are leading the genetic study of the host-pathogen interaction in Ascochyta blight of pea. The disease is caused by three fungal species in complex. This project is in collaboration with Dr Khan from the Department of Food and Agriculture WA and is the subject of Mr Kessie's PhD project (MU - Murdoch International scholarship).

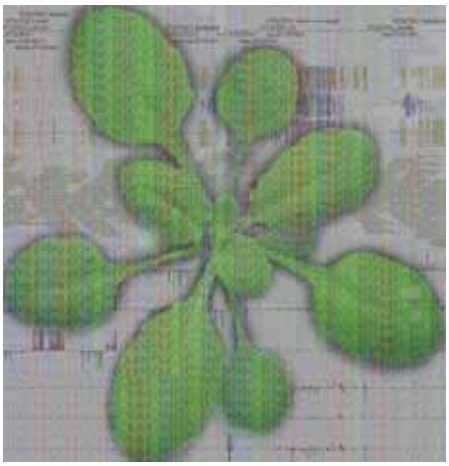
Karam Singh

At CSIRO, Dr Singh, Dr Gao and Dr Lichtenzveig have undertaken the investigation of *M. truncatula* resistance to spotted alfalfa aphid. This project, focus of Mr Peng's PhD studies (UWA), is part of a larger collaborative project between the laboratories of Dr Singh (CSIRO Plant Industry, WA) and Dr Edwards (CSIRO Entomology, WA) aiming at dissecting the molecular mechanisms of resistance to various species of phloem-sucking aphids.

The ARC Centre of Excellence in Plant Energy Biology at the University of Western Australia

Contributed by H Millar (harvey.millar@uwa.edu.au) and J Whelan (seamus@cyllene.uwa.edu.au)

This Centre (plantenergy.uwa.edu.au) contains nodes at the Australian National University and the University of Sydney, making a consortium of Australian plant scientists focused on the biology of cellular organelles. The Centre is dedicated to discovering and characterising the molecular components and control mechanisms that drive energy metabolism in plant cells. This is vital for determining the timing and rate of plant growth and development, the biomass and yield of grain, fruits and crops, the efficient use of water and mineral nutrients and the tolerance of plants to environmental stresses such as excess light and drought. Recent projects of interest include:



Epigenetic analysis of Arabidopsis through deep sequencing:

This is a major collaboration with the Salk Institute in San Diego in the analysis of deep sequencing data to reveal a single base resolution map of over 2 million methylation sites. This study provides an integrated

analysis of changes in mRNA and smRNA when methylation patterns are changed, providing a broad landscape of epigenetic mechanisms in plants.

Lister R, Ronan C. O'Malley RC, Julian Tonti-Filippini J, Gregory BD, Berry CC, Millar AH, and Ecker JR (2008) Highly integrated single base resolution maps of the epigenome in Arabidopsis. Cell (published online 17th April)

Website for data: neomorph.salk.edu/aj_salk/epigenome.html

Biogenesis of mitochondria in plants

This research is undertaken in both Arabidopsis and rice to uncover the factors that influence the building of mitochondria, the powerhouses of cells. This work extends from understanding the receptors on plant mitochondria that drive growth through protein import (Lister et al 2007) to the role of oxygen as a regulator of plant gene expression that defines the building of mitochondria in rice germination (Howell et al 2007) to the heterogeneity of mature mitochondria in different plant tissues (Lee et al 2008). This research is a precursor for systematic modelling mitochondrial function in plants in collaboration with the WA State Centre in Computational Systems Biology (www.plantenergy.uwa.edu.au/ce4csb/).

Lister R, Carrie C, Duncan O, Ho LHM, Howell KA, Murcha MW and Whelan J (2007) Functional Definition of Outer Membrane Proteins Involved in Preprotein Import into Mitochondria. The Plant Cell 19:3739-3759

Howell KA, Cheng K, Murcha MW, Jenkin LE, Millar AH, Whelan J. (2007) Oxygen initiation of respiration and mitochondrial biogenesis in rice. Journal of Biological Chemistry 282:15619-15631

Lee CP, Eubel H, O'Toole N, Millar AH (2008) Heterogeneity of the mitochondrial proteome for photosynthetic and non-photosynthetic Arabidopsis metabolism. Molecular & Cellular Proteomics (published online April 1).

School of Plant Biology, University of Western Australia

Please visit www.plants.uwa.edu.au for more information on these and other research projects within the School of Plant Biology.

Compiled by P. Finnegan (Patrick.Finnegan@uwa.edu.au)

Genome interactions in Brassica

The Canola genetics and breeding group within the School of Plant Biology is focusing on its research on the genome interactions of *Brassica* wide hybrids including the examination of pollen/pistil interactions, production of wide hybrids and homologous/homoeologous chromosome pairing. There are two clear goals of the projects: one is to introgress useful genes/traits to canola (*B. napus*) from related species and another is the creation of "Super *Brassica*" by combining different genomes in the genus. The research is supported by several ARC, ACIAR and UWA projects and the research leaders include **Wallace Cowling**, **Guijun Yan**, **Julie Plummer**, **Matthew Nelson**, **Sheng Chen**, **Ping Si** and **Shyama Weerakoon** with PhD students Ms **Aneeta Pradhan** and Ms **Annaliese Mason** involved. For any further information related to the research in *Brassica*, please contact Associate Professor **Wallace Cowling** at wcowling@plants.uwa.edu.au or Dr **Guijun Yan** at gyan@plants.uwa.edu.au.

Herbicide Resistance

The Western Australia Herbicide Resistance Initiative (WAHRI) within the School of Plant Biology is a plant science research team led by **Stephen Powles** that is focussed on understanding many aspects of the evolution in plants of resistance to herbicides. Research in WAHRI extends from understanding resistance at the molecular level by identifying gene resistance endowing mutations through to the management of resistance in Australian agriculture. Projects in these areas are led by research associates **Michael Walsh** (Resistance Management), **Qin Yu** (Resistance Biochemistry), **Roberto Busi** (Resistance Evolution) and **Danica Goggin** (Seed Dormancy Biochemistry) and involve PhD students **Saiful Hamdani** and **Sudheesh Manalil** and visitors **Martin Vila-Aiub** (University Buenos Aires) and **Ibrahim Abdallah** (University of Cairo). WAHRI receives substantial funding from the Grains Research and Development Corporation as well as three ARC Linkage grants and an ARC Discovery grant. Please visit our website for more detailed information on our work: www.wahri.uwa.edu.au

Linking P Nutrition of Australian Native Plants to Phytophthora Susceptibility

Phytophthora infestations cause widespread devastation of plant communities in Western Australia

Many Western Australian plant species are extremely susceptible to *Phytophthora cinnamomi* (*Phytophthora* Dieback), making this introduced pathogen the most significant threat to landscapes and biodiversity in the south-west of WA. Its severe disruption of plant community structure causes decline in species richness and abundance, degradation of faunal habitat and changes to ecosystem function and health. The continued degradation of the State's social and biodiversity assets is causing escalating management costs to governments, industry and the community. **Hans Lambers, Patrick Finnegan, Susan Barker** and **Guijun Yan**, along with their collaborators at Murdoch University, **Giles Hardy** and **Phil O'Brien,** and industry partners WA Department of Environment & Conservation, Alcoa World Alumina, BHP Billiton Ravensthorpe Nickel, Worsley Alumina, Tiwest, Chemistry Centre (WA), Dardin Agri-Holdings and Western Power have recently been awarded an ARC Linkage grant to unravel a hypothesised link between the phosphate metabolism of Australian native plants and their susceptibility to *Phytophthora cinnamomi*. Our working hypothesis is that a modification in the plant signal-transduction pathway between sensing the internal P status and down-regulating P-uptake capacity has led to a weakening of the defence against *P. cinnamomi*.

New perennial pasture legumes for southern Australia

Megan Ryan and collaborators are searching for novel perennial legume pasture species for areas of the Australian wheatbelt where no options are currently available. Both exotic and native species are being examined, with exciting possibilities already identified, particularly from native species of *Cullen*. Projects evaluating the perennial legumes cover a wide range of areas. Postdoctoral fellow

Aspects of Richard Bennett's Cullen *evaluation activities in Perth.*

Jiayin Pang has found that several species show greater biomass accumulation than the current major perennial legume, lucerne, under low phosphorus (P) conditions. Four native legumes, among 11 perennial legumes studied, had higher concentrations of carboxylates in the root rhizosphere than lucerne, which may allow plants to access additional pools of soil P. Glasshouse studies on the physiological responses of novel perennial legumes to different P sources and the physiological mechanisms that allow plants to survive a dry summer under low P conditions are currently underway. **Richard Bennett's** PhD studies are focused on identifying species of *Cullen* well-adapted to the low rainfall wheatbelt of Western Australia which possess suitable agronomic traits for domestication. Ecogeographic modelling predicts eight species to be suited to the environment in this region and all available germplasm of these have been trialled in Perth and in the target environment. In the wheatbelt, under low rainfall conditions, accessions of several species outperformed lucerne in terms of survival and biomass production. To aid anticipated plant breeding activities, PhD student **Lori Kroiss** has developed microsatellite markers which can be used to estimate outcrossing rates for, and identify hybrids among, species of *Cullen*. Lori is beginning the first molecular phylogenetic work for this genus. Other students working on *Cullen* are examining their tolerance of difficult soils (highly acid or alkaline, subsoil constraints) and aspects of field agronomy such as water use and herbicide tolerance.

Phloem translocation of signalling molecules

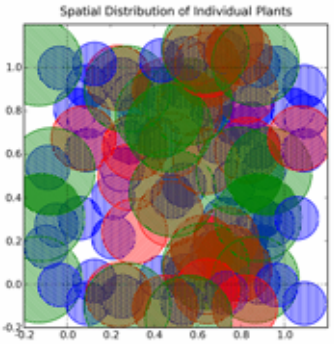
Long-distance translocation through phloem functions as a nutrient delivery system and as a signalling pathway through which molecules such as growth-regulators or bioactive peptides, proteins and RNAs are disseminated throughout the plant. This translocation of signals is involved in coordinating development and allowing the plant to respond to environmental conditions. Our research group of **Craig Atkins**, **Penny Smith** (University of Sydney) and PhD student **Caren Rodriguez** is interested in the analysis of phloem as a conduit for signals communicating distantly located organs. We aim to identify signalling molecules like proteins, mRNAs and microRNAs present in the phloem translocation stream of *L. albus* which is among the few species that can exude significant amounts of phloem from incisions made in the vasculature at a number of sites on the plant and at both source and sink organs. We are currently using mass spectrometry for the identification of proteins and peptides and we are also analysing a cDNA library obtained from phloem exudate. A study of the miRNAs that could be being translocated in phloem is also being performed and we are hoping to identify the proteins that could be involved in their translocation. Phloem proteins have been isolated and separated by two dimensional (2-D) electrophoresis. We have been using partial amino acid sequence determination by tandem mass spectrometry for the identification of peptides and proteins extracted from single 2-D spots. To date, 130 spots in a mass range from 5 to 35 kDa have been analysed and the identity of the 2-D spots, for which a good fragmentation spectra was obtained, is being predicted based on similarity to database sequences. Proteins present in phloem exudate of *L. albus* include those involved in metabolism like malate dehydrogenase, enolase and S-adenosylmethionine synthetase, proteins with redox and antioxidative properties like thioredoxin h and peroxidase, proteins involved in cell wall and structural components like actin and profilin. Interestingly, one of the spots contained a homologue of flowering locus T (FT) protein which has been described as the long-distance signal that induces flowering in Arabidospsis[1]. We have also used the technique of Laser Microdissection and Capture to collect vascular and parenchyma cells separately from thin sections of the vascular traces in the sutures of developing lupin fruits. The technique presents considerably technical difficulties but has resulted in adequate levels of good quality RNA for a separate transcriptomic analysis of the two groups of cells.

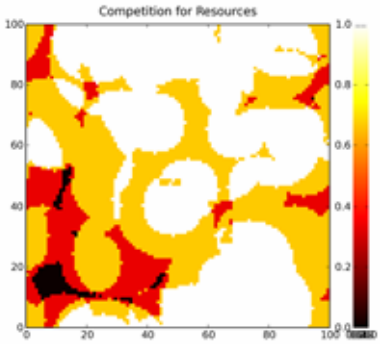
1. Corbesier L. *et al*. (2007) Science 316: 1030-1033.

Plant Modelling

Michael Renton is a relative new comer to the School of Plant Biology, taking up a lectureship in Plant Modelling and Agro-ecology in July 2007. The work he is doing (with help from **Michael Airey, Fumie Horiuchi, Sudheesh Manalil, Padmaja Ramankutty, David Savage, Lalith Suriyagoda** and **George Wyatt**) focuses on computational simulation modelling of plants in complex biological, agricultural and ecological systems, including areas such as:

- evolution of herbicide resistance in weeds in agricultural systems and the effect of different genetics and management strategies on the rate of this evolution;
- competition between species, individual plants, and parts of plants and the effect of spatial patterns on this competition;
- weed seed bank population dynamics and the effects of different seed biology and management strategies;
- seed dormancy and germination, and the influence of environmental factors and management options;
- the way that plant structure emerges over time in relationship with physiology and environment;
- water use, root architecture, drought and climate change, in relation to applications such as the prediction and management of the establishment and survival of annual and perennial crop and pasture plants in drought-susceptible environments, or the long-term health of natural ecosystems in the face of climate change;
- constructing useful decision-support systems for managing agricultural and natural ecosystems;
- the spread of biological organisms such as weeds, crop diseases, and seagrasses.





Simulation of the effect of spatial patterns and variability on intra- and inter-species plant competition for limited available resources.

The modelling approaches they use include:

- individual-based simulation;
- continuous and discrete dynamical systems, including chaotic systems, stochastic systems and S-systems;
- constructing statistical 'summary models' to represent more complex bio-physical simulation models;
- numerical/computational simulation of the movement of biological substances or organisms;
- L-systems for modelling dynamic plant architecture;
- statistical modelling including regression and multivariate analysis.

Some interesting animations of plant models can be seen at:
www.plants.uwa.edu.au/pgweb2/michael.renton

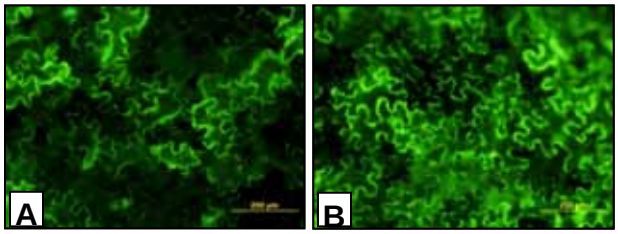
Plant Water and NutrientUuse

The research of **Erik Veneklaas** focuses on plant water and nutrient use in a range of natural, rehabilitated and agricultural ecosystems. He is working with several postgraduate students and with research associates in the following areas:

- Ecohydrology: how does vegetation interact with soil hydraulic characteristics and climatic conditions? This work has implications for understanding resource partitioning in natural communities, and for engineering man-made communities with defined hydrological outcomes, e.g. no-recharge agroecosystems (in the context of dryland salinity) and store-and-release systems (minesite rehabilitation of potentially toxic waste dumps).
- Tree decline and the possible role of climate change. The southwest of WA has experienced a drying trend which is expected to continue. A number of woodland trees is under severe stress. We are hypothesising that long-term drought stress has weakened trees and made them vulnerable to secondary health problems. We have obtained state funding for a Centre of Excellence, in collaboration with colleagues at UWA and Murdoch University.
- Plant water relations: diversity and convergence in Mediterranean-type and semi-arid communities. I am interested in adaptations and trade-offs. I also do some work on crop species and plantation trees. How do plants optimise different patterns of water availability?
- Photosynthesis of sclerophyllous species, in particular *Banksia* species. We are trying to understand relationships between physiological and morphological traits, including mesophyll conductance to CO_2 and stomatal crypts.
- Nutrient uptake and nutrient use efficiency, in particular related to phosphorus. I continue research on cluster roots in native Proteaceae and crop species. My focus is on the functional ecology of the proteoid root strategy in the field, and on the potential value of this strategy in plant production.
- Ecophysiology of genetically distinct populations. In collaboration with the Kings Park Science Division (Krauss lab) we are testing the fitness of local and non-local genotypes of species that are used in land rehabilitation.

Regulation and co-ordination of plant metabolism

Thomas Martin and his Plant Metabolic Signalling Group are interested in the co-ordination of signalling response pathways in plants. Proteins encoded by '14-3-3' multigene families are considered key players in bringing various sensing, signalling and response pathways together (Comparot et al., 2003, J. Exp. Bot. 54: 595-604). 14-3-3 proteins interact as homo and heterodimers with a variety of other plant proteins, mostly at phosphorylation sites, including key enzymes of nitrogen and carbohydrate metabolism, protein kinases and other signalling molecules. These interactions influence enzyme activities and thus alter plant resource allocation on a global scale. We are interested in these interactions and how individual members of the 14-3-3 gene family contribute to distinct regulatory pathways. We employ reverse genetic approaches to identify phenotypes of single and multiple 14-3-3 *Arabidopsis* mutants in response to nutritional and environmental factors. One of our key strengths is based on an *in planta* protein interaction system based on Bimolecular Fluorescence Complementation (BiFC, Walter et al., 2004, Plant J 40: 428-38). This system allows us to investigate how 14-3-3s act in combination with each other and with specific target proteins (see Figure next page).



BiFC analysis of in planta *14-3-3 homo and heterodimer formation.*
Fluorescence indicates homodimerisation of 14-3-3 mu (A) and heterodimerisation of 14-3-3 mu with 14-3-3 lambda (B) in Nicotiana benthamiana *leaves.*

Root penetration

Xinhua He is a new Research Fellow in the School of Plant Biology, arriving just before Christmas 2007. His future studies are to validate the use of thin wax-layer technique (see Figure) for assessing wheat root penetration through soil hardpans. The work is supported by the Grains Research Development Corporation's Initiative "Root Systems for Australian Soils" and will include:

- A mechanistic study to confirm the benefits of rapid root elongation ability, hardpan penetration ability, or both, to improve access of roots to water and nutrients from deeper soil layers.
- Screening doubled-haploid lines (DHLs) from the Cranbrook (poor) x Halberd (good) population, in order to identify genetic control of these traits, including quantitative trait loci.
- Field validation studies on sandy duplex and red clay soils at Merredin, using contrasting cultivars [Cranbrook and C18 (poor) vs Halberd and Bonnie Rock (good)], and contrasting DHLs from the Cranbrook/Halberd population.

In conjunction with previous experiments (1, 2), the expected outcomes will permit assessment of genotype by environment interactions for root traits, identification of desired traits and lines for greater root access and water and nutrient acquisition from depth, and the likely benefits from incorporating these traits in a breeding program.

1. Botwright Acuna, T. and Wade, L.J. (2005). Root penetration ability of wheat through thin wax layers under drought and well-watered conditions. *Australian Journal of Agricultural Research* **56**: 1235-1244.

2. Botwright Acuna, T., Pasuquin, E., Wade, L.J. 2008. Genotypic differences in root penetration ability of wheat through thin wax layers in contrasting water regimes and in the field. *Plant and Soil*. **301**: 135-149.

Functional Plant Biology

Autumn - 2008 Update

New editorial management team for *Functional Plant Biology*

Many of you will be aware that FPB has moved from its traditional management structure to one that most scientific journals have adopted – with an Editor-in-Chief who is a research scientist and a group of Associate Editors with international renown who handle papers in their areas of expertise.

I am delighted to accept the position of Editor-in-Chief. The Associate Editors are drawn from the current and past Editorial Advisory Committee, along with international scientists with a long affiliation with Australian science and scientists.

They are:

Murray Badger, Australian National University, Canberra
David Cahill, Deakin University, Melbourne, Australia
Manuela Chaves, Technical University of Lisbon, Portugal
Jann Conroy, University of Western Sydney, Australia
Graham Farquhar, Australian National University, Canberra
Russell Jones, University of California, Berkeley, USA
Anna Koltunow, CSIRO Plant Industry, Adelaide, Australia
Jian Ma, Okayama University, Japan
John Patrick, University of Newcastle, Australia
John Raven, University of Dundee, UK
Sally Smith, University of Adelaide, Australia
Steve Tyerman, University of Adelaide, Australia

These editors represent scientific academic and technical academies in their respective countries. They will handle papers in their area of expertise, with the assistance of Dr Yvonne Cheng, the new Assistant Editor for FPB. Jennifer Henry, who has been Managing Editor of FPB for nearly ten years, has taken up the prestigious position of Executive Editor for Nature, New York.

The strength of FPB has always been its focus on plant processes, and the publication of studies at the molecular and cellular level placed in the context of the whole plant. FPB publishes papers that lead to significant new information about plant functions and their regulation, especially in relation to the natural environment and to changing climate.

I wish to continue this focus, and to encourage authors to submit papers that use a range of approaches to the understanding of plant function. Such approaches encompass studies on gene regulation, molecular genetics, membrane biophysics, biochemistry, regulatory pathways, cell and organ development, whole plant physiology, and plant-microbe interactions.

Focus areas for FPB:

- Emerging science
- Plant growth and development
- Photosynthesis
- Carbohydrate metabolism
- Nutrient uptake and metabolism
- Root-rhizosphere biology
- Reproduction biology
- Seed and fruit biology
- Stress tolerance
- Defence and protection

Functional Plant Biology is produced by CSIRO PUBLISHING, a not-for-profit organisation that publishes a large number of scientific journals in association with the Australian Academy of Science. It is affiliated with our society, as well as the New Zealand Society of Plant Physiology, and the Federation of European Societies of Plant Biology.

I am very excited about the new prospects for the journal. I aim to increase the flow of papers to FPB and to increase the impact factor, by inviting novel papers and by running a series of "Research Fronts". These Fronts will be a group of papers on theme consisting of a focussed review or viewpoint plus 2-4 research papers on the same theme. These may flow from a session at an international symposium or from a specialist meeting. A guest editor will write an editorial or introduction to the theme. We will also consider Special Issues devoted to a conference or theme, however Research Fronts can move more quickly into publication, and give more flexibility for authors and conference organisers alike. Please contact me with ideas for these Research Fronts.

I welcome comments and suggestions from all ASPS members on new initiatives and topics for future issues of FPB. And to see you publishing your best papers in FPB!

Rana Munns, Editor-in-Chief, Functional Plant Biology

Dr Rana Munns
Chief Research Scientist, CSIRO Plant Industry
Email: rana.munns@csiro.au
President-Elect, Australian Society of Plant Scientists

From Our Seed Banks

Meeting reports provided by members from around the country

We welcome meeting reports from all local and international meetings. Please contact Andy Netting (co-ordinating editor) at anetting@unsw.edu.au for further details.

ComBio 2007

We held over our report from the ComBio 2007 meeting from the last issue of Phytogen. In this issue we celebrate the postgraduate students who were rewarded the prestigious poster and oral prizes at the ComBio2007 meeting. We hope their abstracts and well presented posters and orals will inspire more students to submit abstracts/posters/orals at the next ComBio meeting to be held in Canberra in September 2008 (see page 8 for details). The winners from 2007:

ASPS Best oral presentation was made by Caren Rodriguez on the following:

MICRORNAS IN LUPINUS ALBUS PHLOEM

Rodriguez C.[1], Jordan M.[1], Main S.[1], Mann A.[1], Spencer M.[2], Smith P.[2] and Atkins C.[1]
[1]School of Plant Biology, University of Western Australia. [2]School of Biological Sciences, University of Sydney.

The phloem long-distance translocation system functions as a nutrient delivery system and as a signalling pathway through which molecules such as growth-regulators, bioactive peptides, proteins and RNAs are disseminated throughout the plant. This translocation of signals is involved in coordinating development and allowing the plant to respond to environmental conditions. However, the mechanisms controlling macromolecular trafficking and information flow are not well described. Small RNA molecules such as small interfering RNAs (siRNAs) and microRNAs (miRNAs), noncoding RNAs that play an important role in the regulation of gene expression, have been detected in phloem exudate. Translocation of miRNAs remains to be demonstrated. We have identified 11 different miRNAs in *L. albus* phloem exudate through hybridisation and cloning. We have used grafting techniques to study whether miRNAs are translocated through a graft junction in the model plant *Arabidopsis thaliana*. *hen1* mutant scions, with disruption in miRNA biogenesis, were grafted onto wild-type stocks and wild-type scions were grafted onto *hen1* stocks and accumulation of different miRNAs was studied in scions and rootstocks after grafting. To date, there is no evidence of translocation of miRNAs across the graft union from the wild-type to the mutant. However, for miR399, which in Arabidopsis is expressed in response to phosphorus deprivation[1], there is an increase in *L. albus* phloem as its expression increases in leaves in response to a reduction in phosphorus levels. We are currently investigating whether this increase is part of a translocatable signal that allows the plant to respond to low phosphorus.

1. Bari R, *et al* (2006). Plant Physiol: 141: 988-999.

The Portland Press Prize for a Poster was awarded to: Foteini Hassiotou for:

LEAF STRUCTURE AND PHOTOSYNTHESIS IN SCLEROPHYLLOUS *BANKSIA SP.*

Hassiotou F.[1], Ludwig M.[2] and Veneklaas E.[1]
[1]School of Plant Biology, Faculty of Natural and Agricultural Sciences, The University of Western Australia. [2]School of Biomedical, Biomolecular and Chemical Sciences, Faculty of Life and Physical Sciences, The University of Western Australia.

Sclerophylly is a worldwide phenomenon and very common in areas with a Mediterranean climate. The scleromorphic leaf anatomy has the potential to significantly affect leaf nutrient concentrations and the penetration of CO_2 and light into leaves, yet its impact on photosynthesis has been little studied. With the aim of examining the conditions at the cellular level under which photosynthesis takes place, we investigated links between anatomical and physiological traits of *Banksia* spp. (Proteaceae) with different degrees of sclerophylly. A number of indicators of sclerophylly, such as leaf thickness, leaf mass per area (LMA), leaf percentage dry matter and leaf density were considered. High sclerophylly was found to be associated with low leaf porosity and fewer but larger and deeper stomatal crypts. Moreover, species with a higher degree of sclerophylly had higher maximum rates of photosynthesis per unit leaf area. Interestingly, no difference was found in internal CO_2 concentrations and maximum rates of photosynthesis per unit leaf nitrogen and unit chlorophyll between species with different degrees of sclerophylly. It therefore appears that mesophyll cells of sclerophyllous leaves operate in a very similar way as such cells in non-sclerophyllous leaves. We hypothesise that there are anatomical, physiological and/or biochemical mechanisms present in these leaves that ensure high photosynthetic efficiency of the mesophyll cells under sub-optimal conditions.

ASPS Poster prizes were also awarded to Vanessa Melino and Zhiwei Wang for their posters presenting the following abstracts.

Melino V.J.[1], Soole K.L.[2] and Ford C.M.[1]
[1]School of Agriculture, Food and Wine, University of Adelaide, Urrbrae, South Australia. [2]School of Biological Science, Flinders University, Bedford Park, South Australia.

Ascorbate (Vitamin C) is one of several antioxidants associated with the detoxification of reactive oxygen species in plant cells. The presence of large ascorbate pools as well as the simultaneous presence of both oxidised and reduced forms is responsible for maintaining a steady cellular redox balance. However, ascorbate levels are not homogenous throughout the plant, with the highest reportable levels in meristematic and photosynthetic tissue, particularly seeds and young green fruit. The ascorbate system modulates pathways of mitosis, cell elongation, the timing of flowering as well as processes of aging and senescence. Furthermore, ascorbate is a biosynthetic precursor of tartaric and oxalic acid in *Vitaceous* species. In this study we investigate the developmental fluctuations of fruit ascorbate levels, and whether these reflect changes in biosynthesis, catabolism or storage. These results demonstrate a rapid accumulation of each acid pre-veraison when cells are dividing and expanding whilst the post-veraison accumulation occurs at a slower rate. The gene encoding L-idonate dehydrogenase, a key enzyme operating in the ascorbate derived biosynthesis of tartaric acid, reaches its highest expression at fruit set, thereafter rapidly decreasing to residual levels. The ability of the plant cell to maintain significant accumulation of tartaric acid despite reduced expression of one of its key genes may indicate the role of post-translational regulation, perhaps in response to a developmental cue. Additionally, the post-veraison plateau in ascorbate content correlates with a decrease in expression of ascorbate biosynthetic genes suggesting that ascorbate synthesis is reduced rather than the berries reaching a steady state of synthesis and utilisation. Further investigations into the preferred site of ascorbate biosynthesis such as in sink leaves and potential for translocation to the berry could further explain these developmental variations in acid content.

ROLE OF AQUAPORINS IN REGULATION OF WATER TRANSPORT IN ROOTS

Wang Z.W., Hayes M., Gilliham M., Ramesh S., Vandeleur R. and Tyerman S.D.
University of Adelaide, School of Agriculture Food and Wine, Waite Campus, Glen Osmond SA.

Aquaporins have been proposed to have both regulatory and functional roles in the transport of water across plant membranes. We have carried out quantitative real time PCR on *Arabidopsis thaliana* roots and grapevine roots over a diurnal cycle to identify the likely gene transcripts that will have a major role in water transport. In Arabidopsis several genes belonging to the plasma membrane integral protein (PIP: *AtPIP1;1, AtPIP1;2, AtPIP1;5, AtPIP2;2, AtPIP2;3, AtPIP2;4, AtPIP2;5, AtPIP2;7*) and tonoplast integral protein (TIP: *AtTIP1;1, AtTIP1;2, AtTIP2;1, AtTIP2;2, AtTIP2;2, AtTIP2;3*) groups were identified that showed high expression in roots. These were further characterised by functional expression in Xenopus oocytes. AtPIP2;3 showed some water permeability when expressed alone in

Xenopus, but had markedly higher water permeability when expressed with AtPIP1;1. AtPIP1;1 did not show water permeability when expressed alone. A similar relationship was observed between two grapevine PIPs expressed in roots from the PIP1 and PIP2 groups. Using a combination of physiological measurements of water transport and expression profiles of the genes we are currently investigating how this interaction may be involved in regulating water transport by plant roots.

The RN Robertson Travelling Scholarship awarded to Mikolaj Cieslak

I am a PhD candidate in the Department of Mathematics at the University of Queensland, Brisbane. Before coming to Australia, I completed a BSc and MSc in computer science at the University of Calgary in Canada. My current advisors are Dr. Jim Hanan and Dr. Christine Beveridge at UQ, and Dr. Alla Seleznyova at HortResearch, New Zealand.

Kiwifruit vine orchard near the Palmerston North HortResearch Centre

The focus of my research in on developing mathematical and computational methods for modelling physiological and genetic mechanisms of plant development and function. To aid in the development of these methods and to address any relevant improvements which can be made to existing methodology, I am constructing a virtual kiwifruit vine using an L-system based plant modelling platform (see http://www.algorithmicbotany.org). The model will emulate the architecture and physiological processes that govern the vine's growth and development, with emphasis on the integration of models of these processes into one complex dynamical system.

The first prototype of the virtual kiwifruit vine is an empirical model of the control of branching on a managed and mature vine, with shoot development modelled as a Markov process. I have interfaced this model with a light environment model to study the effects of canopy structure on light distribution. Currently, I am incorporating a model of resource allocation. In order to take advantage of a wider range of up-to-date results on kiwifruit architecture and physiology, I visited researchers at the Horticulture and Food Research Institute of New Zealand Limited (funded by RN Robertson Travelling Scholarship). They provided me with advice in the development of this virtual kiwifruit vine, and aided me in calibrating and evaluating the model with measurements done on the real plant.

While in New Zealand, I worked at the Palmerston North Research Centre under the supervision of Dr. Alla Seleznyova who helped me in understanding the existing collection of data on architecture and resource allocation in the kiwifruit vine, and in exploring the physiology, environmental factors and genetic control of the vine's development. I also had a discussion with Dr. Alistair Hall on a model of fruit growth that he is developing. In the future, his kiwifruit model will be combined with my virtual kiwifruit vine.

Over the second week of my visit, I attended the 5th International Workshop on Functional-Structural Plant Models in Napier (my funding was provided by HortResearch and UQ). I presented the current state of my model and discussed my work with scientists from all over the world. For instance, Dr. Ted DeJong (UC Davis, USA) and I discussed how to incorporate his peach tree model, which includes resource allocation, into my kiwifruit vine model. I also examined the possibility of adding biomechanics to my model with Dr. Przemyslaw Prusinkiewicz (University of Calgary, Canada).

During the second part of my visit, I worked at the Te Puke Research Centre where I met with a team of plant scientists working on dry matter allocation in kiwifruit to discuss current experimental results in this area. Dr Peter Minchin, an expert on phloem transport, and I discussed possible ways of modelling sink-source interaction within the L-system modelling framework. This is based on functional-structural plant modelling, which requires a detailed representation of plant growth patterns and branching structure as well as resource transport and distribution within the structure.
At the same time I was in Te Puke, Dr André Lacointe (INRA, France) was visiting, and I was able to consult with him on modelling reserve dynamics and carbon mobilisation, and consequently on modelling secondary growth of organs. In addition to talking about resource allocation, Dr Mike Clearwater and I discussed how to compare experimental data, which he collected for various rootstocks, with model output. Also, he gave me suggestions for incorporating a model of photosynthesis into the virtual kiwifruit vine.

My visit to New Zealand was extremely worthwhile. I was able to receive expert advice from researchers the world over. This included a chance for me to present my virtual kiwifruit vine and to get suggestions for improving it. While visiting the HortResearch sites in Palmerston North and Te Puke, I was given access to the latest experimental results and shown how field experiments are conducted on kiwifruit vines in an orchard. Thus, providing me with access to expertise and facilities outside of that which is available to me and in a field very different from my own.

Acknowledgements
I wish to thank the ASPS for sponsoring my visit to New Zealand through the RN Robertson Travel Scholarship. Thanks to everyone at HortResearch for making my visit a productive and enjoyable one! The additional funding from HortResearch and University of Queensland to attend the FSPM workshop is greatly appreciated. Finally, a special thanks to my advisor Dr Alla Seleznyova for taking such good care of me during my visit.

A visualization of the virtual kiwifruit vine.

Mikolaj Cieslak

IP Roots & Branches

Defensive Publication

Defensive publication is the deliberate publication of information for the purpose of preventing such information being patented.

The concept of deliberately sabotaging a potential intellectual property position appears completely contrary to the interests of protecting one's position in the market place given the imperatives to commercialise which accompany much research and development work these days.

However, the deliberate selective blocking of IP rights, along with building of IP rights can form an important part of an overall intellectual property strategy for managing IP assets.

Larger organisations may generate a substantial amount of research suitable for patenting; but, the costs of extensive patent filing and the commercial direction of the organisation will often cause it to select particular work for filing and hold the remainder in abeyance. A problem can occur when another party files a patent application for the same or similar work to that held in abeyance, either coincidently or deliberately. If such work is patented, the other party can exercise its IP rights and endeavour to stop the first organisation from using its own research. A similar situation can occur with individual inventors who cannot afford or fail to patent an invention, but eventually seek to commercialise the work only to find that another party has patented "their" invention.

While prior user rights exist in some countries as a defence to infringement, the defensive publication of such work may prevent the grant of inappropriate patents and protect the first party from considerable inconvenience and possible expense in litigation.

Defensive publication is based on the fundamental IP concept of "novelty", where an invention must be deemed "novel" or sufficiently different to the prior art by a patent examiner to secure grant before the patent office. What constitutes the "prior art" varies depending on circumstance; but, the object of a defensive publication is to have the information in question qualify as "prior art" **before** any patents are filed. In this way, when and if a patent application is subsequently filed the patent office can take note of the defensive publication of the information as valid prior art and deem the lacking novelty and be refuse grant.

In order to ensure a defensive publication forms part of the prior art it is necessary to do the following:

1. Publish a comprehensive document including an enabling disclosure of how the information will be put to practical use with examples.
2. Establish an unambiguous publication date quickly.
3. Ensure the publication is accessible to the public (including patent examiners).

The best way to ensure a patent examiner sees the publication as prior art is to file the document as a patent specification at the patent office. Of course, one reason you are publishing defensively is to avoid the cost of patenting: but a patent filing fee without examination and grant fees can greatly reduce costs. Unfortunately, patent applications are generally not published until 18 months after filing unless a request for early publication is made; so patent filings are not a fool proof way of publishing defensively.

Alternative publishing methods are available which satisfy the general requirements including the following:

(a) The special publication series of the U.S. Patent and Trade Mark Office called Statutory Invention Registration (SIRs). SIR's are categorised according to the U.S. patent system which enhances their accessibility.
(b) IP.com provides a commercial service for defensive publication (www.ip.com).
(c) Commercial public disclosure providers including "Research Disclosure" (www.researchdisclosure.com).
(d) Mr Peter Karge provides a professional service including editing and review for defensive publication.

Many other commercial providers are available (the above suggestions are guidelines only and not recommendations).

Self publication can also be effective providing the requirements as outlined are satisfied.

Mark Wakeham
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Postcard from New York

Hello everyone,
I have now been in NYC just 7 weeks. Life here is simultaneously exciting, frustrating, full-on, colourful, exhausting, thrilling and overwhelming, and we love it.

Moving one's life from Oz to NY is no mean feat. Add to that two daughters under 4, a husband who had only just resumed his career after 6 months as a stay-at-home Dad, and an only-*just*-completed renovation. On the day of accepting the position, I resigned from my job of 8+ years, finishing up just before Christmas. It was all Go Go Go to pack up my office, write handover notes to my yet-to-be-appointed successor, get the house ready to lease, and arrange the myriad things we need to arrange to get a young family of four over to the Big Apple. This included sussing out where we might live, deciding which path we take regarding child care, and shipping quotes for the stuff we couldn't take on the airplane.

Before we left, I even practiced NY-style cooking by whipping up a dish of buffalo wings for my family, straight out of the Australian Women in New York (AWNY) newsletter. Hmm, a taste of things to come: this meal had 70% meat, 25% fat, and 5 % vegetable matter. I baked a cake to take to our daughters' last day of crèche. Don't tell GWB, but I could not find white stars to save my life, so, according to this soon-to-be new arrival, the US flag had an unusually small number of yellow stars, and fewer stripes...

We then flew Melb-LA-NY. With two little kids, little me say no more other than that I am reluctant to take that hideous flight again until the girls are old enough to manage their own meals/headsets/in-flight entertainment and let me relax! For the first 6 weeks in NY, we stayed in a company apartment on W 34 st, between Fifth ave and Broadway, on the same block as the Empire State Building. This was great for getting our bearings, but pretty full-on every time we stepped out the front door, straight into fast streams of commuters and pedestrians, all in their NY hurry. We set about interviewing nannies, and ended up with one who was actually from Sydney. Our other priority in those early weeks was finding our own apartment, and we have settled into a place we love, upstairs from a Japanese restaurant on Fifth ave, Park Slope.

I started work just 2 weeks after landing, and the job is like NY life: exhausting, exhilarating, coffee-fuelled, and thoroughly rewarding. My office in Soho has a great view over the water. I saw Steven Spielberg the other day, while walking to my local subway station. I must have gained 1 kg already from trying all the new food, but also get up at 6 am three times a week to job around Prospect Park. We have already met up with a few other Australian families living near us with young kids, for play dates, to moan about the everyday stresses of settling in, and to complain about inefficient US bureaucracy! We then go back to thoroughly loving every minute of being here. New Yorkers are generally very welcoming to young families, and we constantly get stopped on the street so people can listen to our girls' "cute accents".

I am now Publishing Manager on a series of biomedical journals, with Impact Factors ranging from 3 to 8, and do have time to miss the plant science community back home. Feel free to contact me on j.henry@natureny.com if you are ever over this way.

Regards, Jennifer Henry

Did you know....?

- ***ASPS turns 50 in 2008.*** Many celebrations are planned. Several will centre around the annual meeting of ASPS at ComBio in Canberra in September 2008. For further details see page 10.

- ***Goldacre Awards.*** Nominations for this prestigious award will close mid April, 2008. Please give thought to nominating a deserving recipient. Guidelines and selection criteria are outlined in the relevant web pages (click the button 'Awards').

- ***Teaching Awards.*** Nominations for this prestigious award will close late May, 2008. Please give thought to nominating a deserving recipient (see page XXX). Guidelines and selection criteria are outlined in the relevant web pages (click the button 'Awards').

- ***ASPS Website.*** The ASPS website has been thoroughly revamped. **Importantly, *MEMBERSHIP DUES* can now be paid on line.** We would like to remind you that if you wish to advertise jobs, PhD scholarships, conferences, books, etc. you can contact Caitlin Byrt via advertise@asps.org.au. To cover the costs involved, the society has introduced a small charge of $30 for members and $70 for non-members *FOR EMPLOYMENT ADS ONLY*. Advertising conferences and books (edited by society members or containing chapters written by society members) are *FREE OF CHARGE*.

- ***RN Robertson travelling fellowship.*** The named Fellowship recognises and celebrates the sustained contribution made by RN Robertson (Sir Bob) in nurturing young plant scientists in Australia spanning across four decades from the 1950's. The Australian Society of Plant Scientists is indebted to Hank Greenway and Joe Wiskisch who generated and championed the early development of the RN Roberston Travelling Fellowship.

- ***Student Travel Funds.*** Funds are set aside each year to sponsor student travel to our annual conference (next year in Canberra), and contribute to their professional development in plant science. Support will vary from year to year depending on the Society finances, location of meeting and number of applications. The Treasurer will apply a formula in calculating individual entitlements and takes these factors into account. Applicants must be financial members of ASPS and presenting a paper or poster at the ComBio meeting.

- ***Postgraduate Section.*** We are proud to announce that student members who have recently completed their PhD and had their thesis passed can submit a summary that features in Phytogen. The editors feel that this is an important opportunity for our postgraduate students to showcase their research. Such successful student members are

advised that the summary can be accompanied by a key image in suitable format and that they should submit their items to the editors of Phytogen by the first of April, August or December to appear in the April (or May), September or December issues.

- ***Society funding for Workshops and Conferences.*** The society has a total of $10,000 available each year to provide seeding money and sponsorship for up to four conferences organised by members. The amount available to assist each conference will be about $2500. For more details see the website: http:/www.plantsci.org.au and take the link to conferences.

- ***Corresponding and Life memberships.*** Life Membership recognises an outstanding and sustained contribution to the Society by along standing ASPS member who, through their professional activities, has substantially enhanced the international profile of Australian plant science research. Corresponding Members are high profile overseas colleagues who have contributed substantially to plant science research within Australia. If you know of a deserving recipient for Life or Corresponding Membership, please consider putting a nomination forward. The procedure to follow is outlined on the ASPS website (see: http://www.plantsci.org.au/ and click on "About ASPS" where there is also a list of Life and Corresponding members).

UPCOMING CONFERENCES

UPCOMING CONFERENCES

ComBio2008

National Convention Centre, Canberra, Australia. 21 - 25 September, 2008

For details see page 8

12th International Lupin Conference

Fremantle, Western Australia

14-18 September 2008

Convenors: Mark Sweetingham and Jon Clements

www.lupins.org

APGC Symposium: "Plant Functioning in a Changing Global Environment"

University of Melbourne, Melbourne

Sunday 7 to Thursday 11 December 2008

Contact: the local organiser and ASPS representative for Whole Plants, Michael Tausz (Michael.tausz@unimelb.edu.au)

http://www.apgc.eu