PHYTOGEN

A
NEWSLETTER
FOR
AUSTRALIAN
PLANT SCIENTISTS

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INSIDE THIS ISSUE

A big thanks to all the scientists who contributed to this issue of Phytogen. The Editors' would like to encourage any member of the society to contact us if they have an article or any news item that they would like to share with Society Members in Phytogen.

Editors' corner

Dear Fellow Society Members,

This issue has turned into a bumper issue with several exciting articles. The "state of affairs" collated by Ros Gleadow certainly shows that there is a wide range of research occurring in plant sciences in Victoria ranging from molecular biology and metabolomics to ecophysiology. I certainly hope that you enjoy reading this and the other regular features of Phytogen such as the IP issues and Functional Plant Biology update.

In my last editorial, I talked about the importance of communication and how it is important for members to make the most of the handy vehicle offered by Phytogen. This is still a central issue. Not only can members contribute to the "state of affairs" section when it is their state's turn (a two year roster is in place and Western Australia will feature in the next issue) but members should also make use of the other means open to them in Phytogen. For instance, we welcome reports from local, national and international meetings relevant to plant science; so please send reports to Andy Netting (anetting@unsw.edu.au) who is co-ordinating "From our Seed Banks". We would also like to alert you to the "Did you know" and "Discipline Perspectives" sections. These sections serve as a means to keep members abreast of developments that the society undertakes and also to alert members to interesting items of news regarding our members and plant science in general. Please keep the items coming (your discipline representatives are listed on page 2).

ComBio is the major annual meeting for ASPS members and is held in the mid-semester break (late September / early October). ComBio is a combined meeting of three Australian science societies representing biological sciences (sometimes including the New Zealand societies) which means that each meeting can offer a remarkable opportunity for synergism between members interests but also, and perhaps more importantly, opportunities for cross fertilisation of ideas and techniques. I still clearly remember a key cross fertilisation experience that I had during my PhD when I attended a session on a new type of signal transduction involving calcium. As Bob Michell explained how IP_3 was formed and could induce the release of calcium, the pennies were dropping and suddenly I could envisage testable hypothesis that I could use to explain a whole series (18 months) of odd results. I returned to the lab and carried out a very productive 12 months of experiments and easily wrote up my thesis with a final chapter suggesting yet more hypotheses that could be readily tested. This experience has always been an important lesson to me to attend plenary talks and sessions that may be on the outskirts of (or even beyond) my interests. One never knows when that penny may drop again and what exciting connection of ideas may turn into a fruitful synergistic association and possible collaboration. ComBio offers many such opportunities as well as sessions catering more for our specialist interests. This year ComBio is being held in Adelaide and features 10 plant specific sessions and another 5 plant specific plenary sessions (see p 21). If you are attending, I hope that you take the opportunity to go to as many of these as possible but also please do attend a few of the Biochemistry and Cell Biology sessions; you never know what ideas may be sparked.

Helen Irving

ASPS News

The 2005 Celebration of Excellence in Research and Teaching by ASPS Members

The Australian Society of Plant Scientists is committed to fostering excellence in research and teaching of the plant sciences. Part of this commitment is manifested by the Society recognising outstanding achievements from its membership through prestigious annual awards (Goldacre, Teaching and FPB Best Paper) and memorial lectures (JG Wood and RN Robertson). The JG Wood and RN Robertson lectures alternate. These, together with a seminar by the recipient of the Goldacre Award, are presented at the Annual ComBio Meeting.

The ASPS Executive is delighted to announce the 2005 recipients. Brief descriptions of the award/lecture and a profile of each recipient are outlined below.

2005 JG Wood Lecture – Professor Graham Farquhar

JG Wood was the foundation President of ASPP (1958-1959). He served as an academic in the Botany Department, University of Adelaide, for thirty two years (1927 to 1959) and was Professor and Head of Department from 1935 to 1959. During this period he was instrumental in developing a vibrant research culture that spanned plant ecology, physiology and biochemistry with a commensurate growth in research higher degree students. His particular interests were in physiology and regeneration of arid plants of South Australia and metabolic pathways leading to protein synthesis. His contributions are recognised in a series of biennial JG Wood memorial lectures by eminent plant scientists.

Professor Graham Farquhar has undertaken and led research across a broad range of fields and scales, from integration of photosynthesis with nitrogen and water use of plants, stomatal physiology, isotopic composition of plants and global change. He is a fellow of The Australian Academy of Science and of the Royal Society. He has over 220 research publications and is a leading Australian Citation Laureate. Recently he has published a research article in Nature (Masle J, Gilmore SR, Farquhar GD (2005) The *ERECTA* gene regulates plant transpiration efficiency in *Arabidopsis*. *Nature* **436**, 866-870)

2005 Peter Goldacre Award – Yong-Ling Ruan

Peter Goldacre was an enthusiastic researcher and foundation member of the Society who was held in great regard by his peers. His tragic death in 1960 from stomach cancer at age 34 shocked and saddened all his friends and colleagues. The Goldacre Medal was subsequently established as a lasting tribute to his contribution in plant science and as an encouragement to young researchers within10 years of submitting their PhD. The Award is merit based on discoveries made in a particular area where the recipient has played a leading role and the findings published within the past three years. The Award is determined by a panel comprising both Australian and international researchers, and is proudly sponsored by Functional Plant Biology.

From a field of strong and closely ranked nominees, Dr Yong-Ling Ruan (CSIRO PI, Canberra) was decisively judged to be the most deserving recipient of the 2004 Peter Goldacre Award. Dr Ruan has focused his research on the molecular and cellular basis of cotton fibre elongation. Using a reverse genetic approach, he demonstrated that sucrose synthase (Sus) plays a key and positive role in fibre initiation and early elongation (Ruan *et al*., 2003). This finding represents the first demonstration of a fibre-defective phenotype resulting from altered expression of a 'candidate gene'. Following his early discovery of a temporary closure of fibre plasmodesmata (PD) occurring at the onset of the rapid phase of elongation, he recently provided developmental and genotypic evidence that the duration of PD closure correlated positively with final fibre length attained among cotton genotypes differing in fibre length (Ruan *et al*., 2004). Conclusions drawn from these two studies were verified by characterizing a lintless mutant (Ruan *et al*., 2005) in which delayed expression of Sus correlates spatially and temporally with development of fuzz-like short fibres that do not close their PDs.

Papers on which Dr Ruan's P.L. Goldacre Award was based are:

Ruan Y-L, Llewellyn DJ, Furbank RT (2003) Suppression of sucrose synthase expression represses cotton fibre cell initiation, elongation and seed development. *Plant Cell* **15,** 952-964.

RuanY-L, Xu S-M, White R, Furbank RT (2004) Genotypic and developmental evidence for the role of plasmodesmatal regulation in cotton fibre elongation mediated by callose turnover. *Plant Physiology* **136,** 4104-4113.

Ruan Y-L, Llewellyn, DJ, Furbank, RT, Chourey PS (2005) The delayed initiation and slow elongation of fuzz-like short fibre cells in relation to altered patterns of sucrose synthase expression and plasmodesmata gating in a lintless mutant of cotton. *Journal of Experimental Botany* **56**, 977-984.

Functional Plant Biology Best Paper Award.

The best paper award is sponsored by Functional Plant Biology and ASPS. It recognises excellence in papers published by early career researchers who are first authors. The reviewers of each paper are asked to judge whether a paper can be nominated as best paper, then the Editorial Advisory Committee of the Journal and the Council of ASPS make a final judgement on the award. The Best Paper award for 2004 was to **Megan Lindsay** for the paper (Lindsay MP, Lagudah ES, Hare RA, Munns R. (2004) A locus for sodium exclusion (Nax1), a trait for salt tolerance, mapped in durum wheat. *Functional Plant Biology* **31** (11): 1105-1114). This paper identifies a sodium exclusion trait in tetraploid wheat through careful analysis and properly timed measurements of sodium concentrations in leaves of a population derived from a cross between a salt excluding landrace and the cultivar Tamaroi. A microsatellite marker was identified that was closely linked to the Nax1 locus and this was shown to be linked to sodium exclusion in wheat populations with a more genetically diverse background This paper gives a very clear explanation of how quantitative trait loci are identified and can be used to assist breeding programs.

2005 Teaching Award – Dr Martha Ludwig

The Teaching Award, Sponsored by John Morris Scientific Pty Ltd, recognises excellence, innovation and/or contributions to undergraduate teaching in any branch of plant science within an Australian Institution. Dr Martha Ludwig (Lecturer, The University of Western Australia) is the 2005 recipient of the Teaching Award. Her undergraduate teaching includes major contributions to course offerings in cell biology and plant physiology. Martha communicates a passion for undergraduate teaching that translates into inspiring students to develop a deep curiosity for the subject guided by critical thought. Her lecture material and practical exercises are well organised and pedagogically sound. A distinguishing feature that underpins her outstanding teaching quality is a rigorous maintenance of a reflective diary in combination with actively seeking informed student feedback. Unit surveys indicate an overwhelming appreciation and recognition amongst students for Martha's enthusiastic approach to teaching and learning.

Steve Tyerman, Tim Colmer and John Patrick

DISCIPLINE AND STATE PERSPECTIVES

Ecophysiology Highlights

The program for Ecophysiologists at **Combio2005** is bigger than ever. We have essentially four symposia in the Plant Biology stream: Ecophysiology I and II (water relations and nutrients), Abiotic stress and Tree biology. Also Keith Mott (from Utah) will give a keynote talk on stomatal behaviour. Check the program for details, but these all look like good value. There are heaps of good posters too, which is a great way to see what is happening in the ecophysiology world.

In November, Susanne Schmidt, Mark Hovenden, Ros Gleadow and Sharon Robinson are organizing another Ecofizz meeting. Registrations for **ECOFIZZ 2005: Terrestrial & Aquatic Plant and Ecosystem Physiology: Methods & Current Research** on North Stradbroke Island, 28-30 November 2005 (see details below) are already overdue, so be quick if you want to come. ASPS are supporting the meeting so costs are very reasonable.

North Stradbroke Island: location for Ecofizz2005 in November. (*Photo: Susanne Schmidt*)

Gathering from the submissions to this issue of Phytogen, ecophysiology is alive and well in Australia. My two year term as Epochs/Victorian rep on APSP is up this year- any volunteers?

Ros Gleadow

ECOFIZZ 2005: Terrestrial & Aquatic Plant and Ecosystem Physiology: Methods & Current Research

Arrive - 27 November afternoon/evening
DAY 1 - 28 November: methods and paper presentation sessions at research station and field
DAY 2 - 29 November: methods and paper presentation sessions at research station and field
Dinner on the beach
DAY 3 - 30 November: methods and paper presentation sessions at research station and field
afternoon departure or stay on until December 1
Departure - 1 December: Finish after breakfast

Registration is $50 for students, $150 for everyone else.
Accommodation (there are limited availabilities for each accommodation type):
$32 per night in 8-person bunk room; $37 per night in triple share room; $42 per night in twin share room
Food costs per day are $35 for breakfast, lunch, and dinner.

Steady is a sand island (similar to Fraser and Moreton Island) with diverse ecosystems including mangroves, heath land, *Eucalyptus* and *Banksia* woodland, dunes, wetlands, mini-rainforest, *Melaleuca* swamp which we can visit.

Susanne Schmidt, Mark Hovenden, Sharon Robinson, Ros Gleadow
Organisers of ECOFIZZ 2005

Plant Water Relations Workshop

An international workshop on "Plant Water Relations in Seasonally Dry Environments, with Emphasis on Woody Plants" was recently held at the University of Western Australia, under the auspices of the Cooperative Research Centre for Plant-based Management of Dryland Salinity. The aim was to bring together international expertise to discuss how knowledge of plant function in seasonally dry environments can be used to improve agroecosystems and land management in Australia. The workshop, sponsored chiefly by the Cooperative Research Centre for Plant-based Management of Dryland Salinity (in addition to UWA, Alcoa Australia and ICT International), brought together invited speakers from Europe, USA and Australia. In all, approximately 60 participants enjoyed four intense days of the latest in plant water relations research.

Steve Burgess and Hans Lambers

Focusing on one state's research per edition

Victoria

Collated and edited by Ros Gleadow
(the discipline representative resident in Victoria)

Welcome to the feature article highlighting some of the research in plant science by ASPS members in Victoria.

Deakin University - Molecular responses to plant stress

There are three labs within the School of Biological and Chemical Sciences, Deakin University undertaking plant-based research. Each lab is led by an academic staff member (Professor Bernie Kunz, Associate Professor David Cahill or Dr Morley Muralitharan) with research being undertaken in the general area of plant stress responses. There are currently 6 postgraduate students, nine Honours students and a research assistant. This group, located at the Waurn Ponds Campus, is investigating the responses of plants to environmental stresses including ultraviolet radiation, pathogenic organisms, drought and salinity. The long term aim is to genetically engineer plants with increased resistance to these various factors, an objective with important economic implications for the agricultural and horticultural industries, as well as for the reforestation efforts of the Federal Government. Our research is carried out using a bank of large and small plant growth chambers and glasshouse and plant PC2 facilities. Members of the group have initiated a number of national, international and industrial collaborative interactions with scientists in Australia, Brazil, Canada, Great Britain and the United States. Currently, the research is supported by ARC Discovery and Linkage grants, funding from the Department of Environment and Heritage and Deakin University central research grants.

Research underway includes:

- Isolation, molecular characterisation and functional analysis of DNA repair genes from *Arabidopsis thaliana.*
- Biochemical and cellular characterisation of a novel biologically active plant natriuretic peptide hormone system
- Analysis of the molecular control of plant resistance to bacterial, oomycete and fungal pathogens
- Strategies for protection and rehabilitation of native vegetation communities threatened by *Phytophthora cinnamomi*
- Development of molecular markers in canola for resistance against the blackleg fungus.

Bernie Kunz

Ongoing stratospheric ozone depletion is increasing incident solar UV radiation, a major problem of long-term relevance to agricultural sustainability and the need to feed a growing human population. This, plus the obligate nature of plant exposure to UV, makes it vital to increase the UV resistance of agronomically important plants. One strategy to meet this critical goal is to enhance the ability of plants to repair or tolerate UV-induced DNA damage. However, attempts to do so will depend on critical knowledge of the biochemical mechanisms of DNA repair and damage tolerance in plants. In turn, elucidation of these key processes will rely on characterisation of the relevant genes and proteins. To meet these requirements, my group is isolating and analysing genes and proteins required for the repair or tolerance of UV-induced DNA damage in the plant *Arabidopsis thaliana*.

Not only are plants exposed to UV radiation, they also suffer the consequences of drought, elevated or reduced temperatures, excess salinity and insect and pathogen attack. Given this simultaneous exposure to multiple forms of biotic and abiotic stress, it seems reasonable for plants to have evolved to respond to more than one type of stress concurrently. This could occur by increasing the functionality of specific proteins or controlling different response mechanisms through interacting, or highly related, signalling networks. To assess these possibilities, Associate Professor David Cahill and I are currently investigating relationships between plant resistance to UV radiation and fungal pathogens.

David Cahill

A major challenge in plant biology is to understand the interactions of plants with pathogens. We need to know the basics of these interactions so that crop species or species used in revegetation programs can be made resistant or more resistant to disease. The interactions between plant host and pathogen involve, in their simplest form, complimentary genes that are expressed as compatibility (susceptibility) or incompatibility (resistance). However, multiple genes more often confer resistance to disease-causing organisms. We still do not completely understand how resistance genes act or the nature of their products in each of these systems. To investigate plant responses a number of approaches are being used including monitoring of biochemical changes, investigation of anatomical/morphological alterations, measuring the production of localised defence compounds, analysing gene expression and working with transgenic plants.

Morley Muralitharan

Morley's research includes molecular marker assisted selection (MAS) for disease resistance traits in plants, genome mapping, secondary metabolites, functional food and nutrichemicals. Morley recently presented "Australian biotechnology untapped potential" as a seminar in Singapore, Malaysia, India, Sri Lanka and Australia. Morley's group has a number of collaborations including those with Florigene, the Victorian Department of Primary Industries, CSIRO Livestock Industries, NSW State Forests and NuGrain.

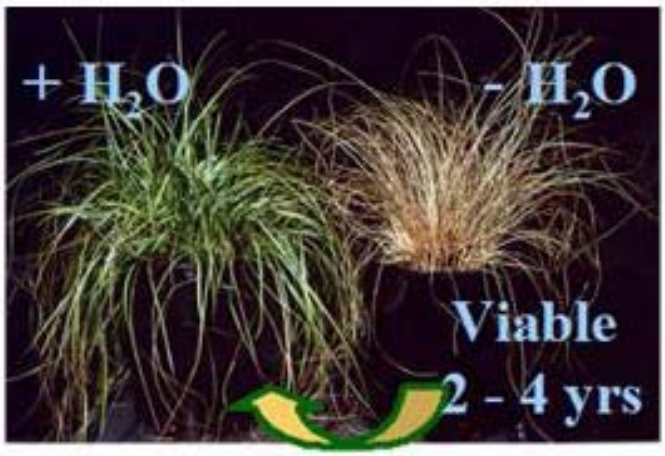
Monash University

News from Biological Science, Monash Clayton

Plant genetics, Monash University

The current focus of the plant genetics group at Monash is on the molecular control of secondary metabolism in plants and plant tissues. **John Hamill** has been focussing on alkaloid biosynthesis and the flow on effects on plant:insect interactions. **Alan Neale** also works on the control of secondary metabolism, but his work focuses on the regulation of glucosinolates in Arabidopsis. The group also has projects on gene expression during floral induction, the molecular physiology of desiccation tolerance in resurrection plants (see picture) and the improvement of commercially important eucalypts via biotechnology. **Ros Gleadow** has joined the group studying the environmental influences on gene expression. The group also has interests in genes important in defensive phenolic production by brown seaweeds (in collaboration with Prof Margaret Clayton also of Monash) and also the production of therapeutic proteins and vaccines in plant tissues cultured in vitro (in collaboration with Dr Diane Webster and Prof Steve Wesselingh of the Burnet Institute of Medical Health in Melbourne).

Another research strength at Monash involves plant developmental genetics. **David Smyth** and **John Golz** work on the function of key transcription factors that control flower and leaf morphogenesis, respectively, using the model plant *Arabidopsis*. They will be joined in 2006 by Federation Fellow **John Bowman** from the University of California Davis.



Above: Desiccation tolerant plants: how do they do it?

Algal Physiology

John Beardall's group at Monash are doing some interesting ecophysiology. Projects in progress include:

1. Effects of global climate change on marine phytoplankton: interactions between nutrient availability, UV radiation and elevated atmospheric carbon dioxide levels.
2. Energetics of microalgae under changing environmental conditions: the roles of linear (non-cyclic) and cyclic photosynthetic electron flow and respiration in resource acquisition.
3. Use of biospectroscopic imaging to investigate the macromolecular composition of algal cells.

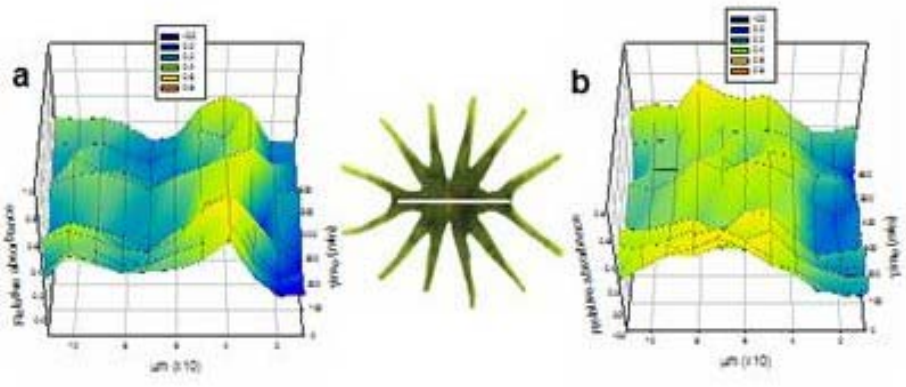
Left: John Beardall

Currently two ARC projects are running in the lab - one on climate change (looking at the interaction between CO2 and UV in microalgae), and the other ARC project is looking at the use of FTIR to detect nutrient limitation in microalgae. Another area of interest is the use of algal biofilms in bioremediation, which is currently being investigated by two honours projects. The effects of the DOC on algae in freshwater streams is a joint honours project with Limnology lab from our department. Ecophysiological investigation of the Mekong river is a PhD project, joint with Wetland group from the department. Strong international collaboration is present at the moment - visitors from Ireland, USA and Israel are involved in several projects in the lab. There are currently 4 post-docs, 4 PhD students, 3 honours project, and 3 visitors.

Probing cells and tissues using spectroscopy and synchrotrons

Phil Heraud and John Beardall, School of Biological Sciences
Don McNaughton, School of Chemistry.

During the 1990s, an increase in the sensitivity in IR spectroscopic instrumentation by three orders of magnitude led to the development of IR microspectrometers capable of recording spectra from microscopic regions of tissue. By the end of the 1990s advances in IR sensitive CCD technology led to the development of imaging spectrometers using focal plane array (FPA) detectors capable of rapidly obtaining images of cells and tissues based on chemical information. Very recently IR microspectrometers have been coupled to synchrotron sources allowing the intense flux of IR photons generated by the synchrotron to probe the macromolecular architecture of single cells (see Figure overleaf).



Time resolved changes in a. lipid (absorbance of carbonyl ester) and b. protein (absorbance of amide II) taken over the longitudinal axis of the *Micrasterias hardyi* cell shown at centre

The Centre for Biospectroscopy at Monash University is a world leader in this area of research focusing on the development of diagnostics for human diseases as well as pioneering the use of biospectroscopic techniques to probe the influence of the environment on algal and plant cells. For further information see the April edition of 'Australian Biochemist'.

Plant Signalling Systems

Helen Irving Pharmaceutical Biology & Pharmacology, Monash University

How are messages (e.g. hormones, stresses, etc) relayed from external sources to stimulate physiological responses in plant cells? This question forms the underlying focus of our research. We are using two model signalling systems to investigate this question and I will focus on the PNP system here.

Plant Natriuretic Peptides. Plant Natriuretic Peptides (PNPs) are highly unusual systemic small proteins that affect several processes that are directly involved in the regulation of plant water and salt balance [1]. PNPs also appear to have a role in modulating plant responses to pathogens and we are investigating this relationship with Assoc. Prof. David Cahill at Deakin University. We identified this class of proteins using a reverse genomic approach [2] and now are investigating the effects of down-regulating PNP levels with our partner investigator Prof Chris Gehring (University of Western Cape, South Africa). Prof Gehring's group has played a critical role in establishing some of the functions of PNP which include modulating water volume of cells (and opening stomata pores) and the systemic movement of PNP. Since growth and survival of all living organisms, including plants, is critically dependent on this balance we predict that PNPs play a major, albeit unknown at the molecular level, role in plant responses to salinity and drought stresses. My specific interest has focussed more on the intracellular signalling mechanisms employed. We know that cGMP is upregulated [3, 4] and we are currently investigating how PNPs and their protein signalling networks interact with other classical hormones such as abscisic acid and biotic elicitors such as plant pathogens. Yu Hua Wang and Marion Wright have joined the group to pursue these studies. This project is funded in part by an ARC Discovery Grant.

Signalling pathways in the legume-rhizobia symbiosis. Marilyn Kelly and I identified various G-proteins and phospholipase C as two key components of the root hair deformation response to Nodulation factors secreted by rhizobia [5, 6]. We are investigating how G-proteins and phospholipase C interact with other aspects of the cellular machinery (e.g. protein phosphorylation cascades) to initiate the host symbiotic responses.

1. Gehring CA, Irving HR 2003 Natriuretic peptides - a class of heterologous molecules in plants. *Inter J Biochem Cell Biol* 35, 1318-22
2. Ludidi NN, Heazlewood JL, Seoighe CJ, Irving HR, Gehring CA 2002 Expansin-like molecules: Novel functions derived from common domains. *J Mol Evol* 54, 587-94
3. Pharmawati M, Gehring CA, Irving HR 1998 An immunoaffinity purified plant natriuretic peptide analogue modulates cGMP level in the *Zea mays* root stele. *Plant Sci* 137, 107-15
4. Pharmawati M, Maryani MM, Nikolakopoulos T, Gehring CA, Irving HR 2001 Cyclic GMP modulates stomatal opening induced by natriuretic peptides and immunoreactive analogues. *Plant Physiol Biochem* 39, 385-94
5. Kelly MN, Irving HR 2001 Nod factors stimulate plasma membrane delimited phospholipase C activity *in vitro*. *Physiol Plant* **113** 461-8
6. Kelly MN, Irving HR 2003 Nod factors activate both heterotrimeric and monomeric G-proteins in *Vigna unguiculata* (L.) Walp. *Planta* 216 674-85

University of Melbourne

Breakdown of resistance to blackleg disease in canola

Barbara Howlett's research group in the School of Botany, University of Melbourne studies blackleg of canola caused by the fungus, *Leptosphaeria maculans*. Activities of members of her group span from developing crop management strategies for farmers, to applying functional genomics to find antifungal targets in the blackleg fungus. See http://www.botany.unimelb.edu.au/blackleg/

A current Ph.D student, Susie Sprague and a previous student, Steve Marcroft, have been surveying damage to canola crops caused by breakdown of disease resistance conferred by a single resistance gene. This was particularly dramatic in 2003 in lower Eyre Peninsula, SA where crop losses were over 90%, costing farmers more than $20 million. The virulent blackleg strains are host-specific, only attacking canola varieties with single (major) gene resistance and not those with polygenic disease resistance (see Figure below). The most likely cause of the resistance breakdown was the rapid increase in frequency of blackleg isolates virulent on this particular resistance source. The selection pressure leading to this increased frequency was probably mediated by the planting of cultivars harbouring the major resistance gene in the same locations for a three-year period. These cultivars are now withdrawn from the market.

The virulent blackleg strains are host-specific, only attacking canola varieties with single (major) gene resistance (at right) and not those with polygenic disease resistance (at left).

This situation highlights the importance of understanding of molecular mechanisms underlying changes in virulence of populations of the fungus. As a consequence, a consortium comprising scientists at INRA Versailles, France, the University of Melbourne and the French sequencing agency, Genoscope, will sequence the genome of the blackleg fungus later this year. Funding for the sequencing has been awarded by the French government and by Grains Research and Development Corporation, Australia. The acquisition of the genome sequence will enable the basic biology and metabolism of this fungus to be elucidated and also novel disease control strategies to be developed.

Ecophysiology Research at SFES

The Ecophysiology group at the School of Forest and Ecosystem Science of The University of Melbourne comprises approximately 13 PhD students and 11 academic/research staff. Our research interests are many and varied. The past 12 months have been extraordinarily successful for the ecophysiology group with >20 papers being published in refereed journals.

Charlie Warren is investigating the economics of C, N and H_2O use in *Acacia* and *Eucalyptus*. Most of his research is examining photosynthesis, in particular limitations due to internal conductance and the potential role of Rubisco as a form of N storage. **Erwin Dreyer** from the Institute National de la Recherche Agronomique (Nancy, France) has recently arrived at The School of Forest and Ecosystem Science for a 12-month sabbatical. Erwin's research will focus on the tolerance of *Acacia* leaves to high temperature and the inter-specific diversity

of traits related to water use and drought tolerance. **Michael Tausz** is mainly interested in tree responses to environmental stress, including pollution and global change. Some specific areas of his research relate to photo-oxidative stress, stress signalling in trees, and systems of antioxidative defence. The past 12 months have also seen regular visits by **Arthur Geßler** (Freiburg, Germany) who has been investigating instantaneous discrimination against $^{13}CO_2$. **Lauren Bennett** and **Sabine Kasel** are developing novel molecular techniques for measuring soil microbial diversity. They will examine relationships between vegetation condition and soil function in rehabilitated forest. **Andrew Callister** is examining the role of physiological measurements in eucalypt breeding. His research is focussing on $\delta^{13}C$, leaf water relations and foliage respiration parameters measured by isothermal calorimetry. Calorimetry is also being used by **Joerg Kruse** to gain a better mechanistic understanding of how light-, N- and water availability affect growth and maintenance respiration. The functional relationships found will be used in growth models of *Pinus radiata*. **Sabine Posch** is a PhD student from the Karl-Franzens-University Graz, Austria. She is examining how *Pinus radiata* trees allocate intercepted light to photosynthesis and photoprotection. **Stefan Arndt** is investigating greenhouse gas emissions and carbon sequestration in forest ecosystems and mechanisms of drought and salt tolerance in tree species. **Stephen Livesley** is investigating CO_2, N_2O and CH_4 gas exchange in soils of agricultural and forest ecosystems. **Peter Miehle** uses process-based models to simulate the carbon and greenhouse gas balance of forest and plantation systems. **John Kaye** is modelling carbon sequestration in native forest ecosystems in Victoria using a combination of process-based and empirical models. John works in close collaboration with DSE's Forest Resource Inventory group. **Andrew Merchant** is investigating the identity and quantity of soluble carbon within plant tissues and how they fluctuate during periods of abiotic stress. **Katherine Whittaker** is examining the extent of CO2 efflux from woody tissues of plantation *E. globulus*. This includes measurement of dark respiration, photosynthetic refixation and the use of C isotopes to establish respiratory sources. **Tarryn Turnbull** is measuring the response of photosynthesis and allocation of nitrogen within leaves to fertilising, pruning and shade in *Eucalyptus* spp. **David Forrester** is examining the growth and physiological responses to high-lift pruning on sites of different qualities, and the processes and interactions that occur in mixed plantations of *Eucalyptus* and *Acacia*. David's pruning work is funded by the Forestry CRC. **Jim Morris** and **John Collopy** are investigating age-related changes in stand water use in young blue gum plantations. Jim is also refining the ThreePG+ process-based model of forest growth and water use, and its linkage to hydrological models for predicting catchment scale impacts of plantation establishment and management. The **Bushfire Research Group** is determining the effect of repeated low intensity fires on the 'unseen' agents of nutrient cycling including litter-dwelling invertebrates, mycorrhizal and saprophytic fungi and soil microorganisms. **Edith Huber** and **Robert Simpson** are investigating the effect of wildfire on N and C cycling and greenhouse gas emissions from alpine vegetation in the Bogong High Plains in Victoria. **Sebastian Pfautsch,** an exchange scientist from the Albert-Ludwigs-University of Freiburg, Germany, is investigating the water and nutrient relations in native Eucalyptus forests (*E. regnans*) in the south east of Victoria, focussing on isotopic signatures and nitrogen.

The Ecophysiology group has been awarded a number of research grants in the past 12 months or so. Mark Adams (UWA) and Michael Tausz were recently awarded an ARC linkage grant entitled "Mid-rotation diagnosis and management options for correction of water and nutrient deficiencies in plantation-grown eucalypts." Stefan Arndt, Chris Weston and Steve Livesley have been awarded an ARC linkage grant, 'Non-CO2 greenhouse gas emissions in afforested ecosystems in south-eastern Australia – fluxes, processes and regional budget'. Charlie Warren, Mark Adams (UWA) and Michael Tausz were awarded a Linkage International Award for collaboration with INRA (France) and The University of Graz (Austria). Charlie Warren also received a University of Melbourne internal grant and a Forestry Tasmania grant for a project on "preference" of plants for different forms of N (nitrate, ammonium, amino acids).

Plant Cell Biology Research Centre
The School of Botany, University of Melbourne

by Tony Bacic (Director) and Ed Newbigin (Deputy-Director)

The Plant Cell Biology Research Centre (PCBRC), founded in 1982 with Professor A.E. Clarke as Director, is housed in the School of Botany and its main participants are Professor Tony Bacic, Professor Adrienne Clarke, Associate Professor Ed Newbigin, Associate Professor Barbara Howlett, Professor Geoff McFadden and Dr Robyn Heath. Major areas of research expertise are cell and molecular biology, biotechnology and structural biology, cell evolution, molecular plant pathology, insect resistance, proteomics, metabolomics and glycobiology. The Centre now has more than 20 postdoctoral fellows, 17 technical staff and 25 postgraduate students.

1. Australian Centre for Plant Functional Genomics Pty Ltd (ACPFG)

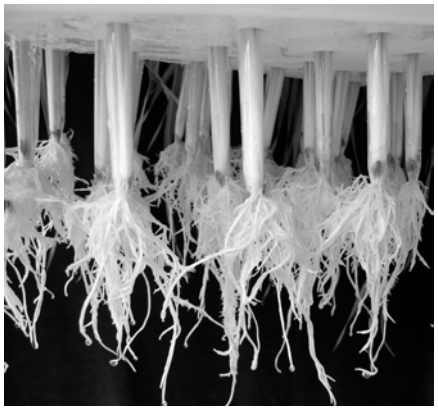
Professor Tony Bacic, Dr John Patterson, Dr Ute Roessner-Tunali, Dr Mark Platt

The Australian Centre for Plant Functional Genomics Pty Ltd is a private company based at the Waite Campus of the University of Adelaide (Prof P. Langridge, CEO & Prof G. Fincher, Deputy CEO), with major nodes at the School of Botany, University of Melbourne (Prof T. Bacic), Victorian Department of Primary Industries (Prof G. Spangenberg) and the University of Queensland (Prof K. Basford).

Research within the ACPFG focuses on developing cereal varieties with increased tolerances to environmental (or abiotic) stresses, for example, salinity, frost, drought and mineral toxicities. The outcome of this research is geared towards sustainable Australian cereal production while simultaneously generating environmental, social and economic benefits. Aside from the research focus, the ACPFG also runs functional genomics - and plant biotechnology y- based educational programs for undergraduate and post-graduate students, as well as community workshops to increase awareness and understanding of the potentials of agricultural biotechnologies.

Boron tolerance: Boron (B) toxic soils are present throughout low rainfall cropping regions of South Australia and western Victoria, but also occur in western Asia and northern Africa. Present estimates are that yield penalties of 15% or more can be directly attributed to excess B. Compounding the problem is the fact that these soils also typically have high subsoil salinity. Presently, all commercial varieties of wheat and barley grown in Australia are sensitive to B.

However, in other areas of the world where excess soil B is found, the local wild wheat and barley plants often show no signs of B toxicity. This suggests that these plants are B tolerant and that tolerance to B has a genetic basis. We are analysing some of these B tolerant barley plants and comparing them to the intolerant commercial varieties currently being grown in Australia. By taking both metabolomic and proteomic approaches to examine the B tolerance mechanism, we hope to identify key factors related to tolerance that can then be used in breeding programs to breed B tolerant commercial varieties that grow well in Australian conditions.
Website: www.acpfg.com.au



Unidentified biochemical processes in barley roots are responsible for B tolerance. To study these processes, plants are grown hydroponically in solutions that contain a known concentration of B.

2. Cereal Functional Genomics Centre

Professor Tony Bacic, Assoc Prof Ed Newbigin, Dr Monika Doblin, Dr Siria Natera, Dr Sarah Wilson

The Cereal Functional Genomics Centre started in 2000 as a collaboration between Professors Geoff Fincher and Peter Langridge from the University of Adelaide and Professor Tony Bacic and Assoc. Professor Ed Newbigin from the University of Melbourne. Core funding for the CFGC comes from the Grains Research and Development Corporation and the Universities of Melbourne and Adelaide.

Researchers in the CFGC use functional genomics to study the biological processes underlying cell wall biosynthesis in cereals. The major polysaccharide in all plant cell walls is cellulose, a polymer made up of β-1,4-linked glucose units. Non-cellulosic polysaccharides in a cereal cell wall include glucuronoarabinoxylan (GAX), which has a β-1,4-linked xylan backbone and side-branches composed of arabinose and glucuronic acid, and mixed-linkage glucan (MLG), a polymer that is much like cellulose in composition except that there are both β-1,3- and β-1,4-linked glucose units. Cloning the genes involved in GAX and MLG synthesis are the major targets of our research program because these polysaccharides, although minor components of the endosperm wall, exert a surprisingly large influence on the quality, end-use processing and nutritional value of cereal grains.

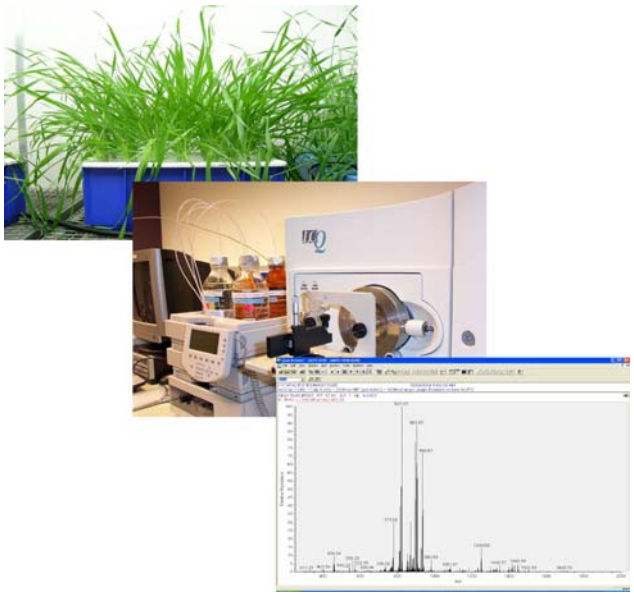
Traditionally one of the ways the function of a gene has been determined is by studying the effects that mutations in that gene have on an organism. Since no mutations are available in barley for any CSL gene, we have taken a slightly different approach to addressing the question of gene function by asking whether any of our barley genes can reverse the effects of CSL gene mutations in the well-studied model plant *Arabidopsis thaliana* (see figure)

The roots of Arabidopsis plants with the kojak mutation are hairless due to a mutation in a CSLD gene. Hairs grow on the roots of a kojak plant transformed with a barley CSLD gene (arrow), showing that this gene has the same function as the Arabidopsis gene. (photo: A. Medhurst).

3. Victorian Centre For Plant Functional Genomics

Professor Tony Bacic, Assoc Prof Ed Newbigin, Dr Barbara Howlett, Dr Mark Platt

The Victorian Centre for Plant Functional Genomics (VCPFG) is a joint venture with the Victorian Department of Primary Industries (DPI) and was established in 2002 by a $4 million grant from the Victorian Government's Science, Technology, and Innovation (STI) program. The VCPFG maintains state of the art facilities, instrumentation, and expertise in all areas of functional genomics and has forged links with other relevant STI programs, such as the Victorian Microarray Technology Consortium (VMTC) and the Victorian Bioinformatics Consortium (VBC). Currently the VCPFG is working collaboratively with the Australian Centre for Plant Functional Genomics (ACPFG), Cooperative Research Centre (CRC) for Molecular Plant Breeding, and the Plant Cell Biology Research Centre (PCBRC).
Website: ***www.vcpfg.com***



4. Cooperative Research Centre for Bioproducts

Professor Tony Bacic, Dr Ming-Long Liao, Dr Shaio-Lim Mau, Dr Filomena Pettolino, Dr Rongwei Teng

The CRC for Bioproducts is an unincorporated joint venture that has 12 participants, as follows
Core participants: The University of Melbourne, Tridan Ltd - Albright & Wilson (Australia) Ltd Partnership, Food Science Australia, Flinders University of South Australia
Supporting participants: The University of New South Wales, Cerebos Foods (Australia), University of Newcastle, The New Zealand Institute of Crop and Food Research, Australian Wine Research Institute, Rhodia (Australia), Unilever (UK), Peplin Biotechnology Ltd

The three research programs are:
(1) *Bioproducts from Plant Cell Culture*
The development of processes to produce valuable compounds by fermentation technology (primarily but not restricted to plant cell culture).
(2) *Bioproduct Applications*
Understanding structure/function relationships in the commercial application of biopolymers.
(3) *Bioproducts from Plant Biomass*
Extraction of valuable compounds from plant biomass, such as agricultural waste and seaweeds.

Highlights in 2004: 2004 was a very busy year for the CRC for Bioproducts. At short notice all hands were on deck to prepare for the CRC Review as part of a new CRC application. The feedback from the review was extremely positive but unfortunately the CRC was notified in late December 2004 that the new bid was not successful and the CRC will be terminating in mid-2006. For most research groups, this news would result in a wind-down of activities but for the CRC for Bioproducts it was seen as a challenge to generate even more successful outcomes from its research.

Establishing new Australian industries based on bioproducts and bioprocesses through commercialisation of innovative research. Dr Ming-Long Liao is the project co-leader for the Pectin project where he and his team are developing new products and processes to support the commercialisation of a CRC-developed pectin technology through Ingredia. Ingredia, a spin-off company of the CRC, is the investment vehicle for the commercialisation of the CRC process. In 2004 the pectin team demonstrated proof-of-concept of the new process at pilot scale. This process will become the basis of a new manufacturing industry in rural Australia for pectin that is all currently imported into Australia for use as a food ingredient, with an estimated world market in excess of US$300 million (and growing).

Generating new knowledge and products to enhance the global competitiveness of existing Australian industries. Collaboration with different companies to enhance the global competitiveness of existing Australian manufacturing industries continued to add to the success of the CRC in 2004. The basis of these collaborations is the use of CRC core technologies in biopolymer structure-function and molecular and cell biology.

- Prof. Tony Bacic, Dr. Shaio-Lim Mau and Dr. Rongwei Teng are developing strong links with Traditional Chinese Medicine (TCM) research groups and companies in China to explore anticancer and immune-stimulating activities of polysaccharide compounds extracted from herbal plant materials.
- Dr. Filomena Pettolino is working closely with the Australian Wine Research Institute (AWRI) on a novel method for clarifying protein haze in white wine. A provisional patent application around this work was lodged through the AWRI in 2004.
- Dr. Rongwei Teng worked with Peplin Biotech Ltd. to develop methods to use plant cell culture for the biotransformation of anti-cancer compounds that are difficult to generate by conventional synthetic organic chemistry.
- Dr. Filomena Pettolino, Dr Ming-Long Liao and Ms Alisa Turbic conducted a project for AMCOR Research and Technology related to packaging manufacture.
- Dr. Filomena Pettolino, Dr. Ming-Long Liao, Ms Alisa Turbic and Ms Georgina Thomas are working on a project to develop a novel clarifying agent for use in beer production. Carlton United Beverages (CUB) was awarded a Food Industry Grant (FIG) to support this project. A provisional patent application was lodged for this unique process through CUB in 2004.

Developing leaders for emerging industries and research institutions. The CRC commitment to education and training has resulted in a number of highlights:

- Four CRC students were enrolled through Botany in 2004: Ms Zhu Ying, Ms Simone Poznanski, Ms Naomi Ling and Ms Indira Prabassari. Ms Zhu Ying completed her PhD in 2004 and has taken a postdoctoral research position at the Walter and Eliza Hall Institute.
- The CRC hosted the 7th International Hydrocolloids Conference (7IHC) in Melbourne from August 29 to September 1, with over 120 delegates attending from 15 countries, representing both research institutions and industry.
- Scientific presentations were given at national (Indira Prabassari - Combio 2004, Perth; Dr. Filomena Pettolino – Australian Wine Industry Technical Workshop, Melbourne) and international meetings (Indira Prabassari - 7IHC, Australia; Dr Filomena Pettolino – Xth Cell Wall Meeting, Italy)
- The CRC held displays to promote its research capabilities and skills at The University of Melbourne 2004 Research and Innovation Fair in Melbourne and the CRC Association Conference in Adelaide.

ComBio 2005 Update

This year the executive provided funding for international speakers in each symposium. The plant-based symposia are:

1. **Tree Biology** (Chair: Jim Reid)
2. **Ecophysiology-Nutrients (**Chair: Susanne Schmidt)
3. **Ecophysiology-From water to secondary metabolites** (Chair: Roslyn Gleadow)
4. **Plant Abiotic Stress** (Chair: Barry Pogson)
5. **Plant Nutriomics** (Chair: Mark Tester)
6. **Hormones and Plant Development** (Chair: John Ross)
7. **Genetic and Metabolic engineering of plastids** (Chair: Spencer Whitney)
8. **Plant Pathogen Interactions** (Chair: Richard Oliver)
9. **Plant Metabolomics** (Chair: Kathleen Soole)
10. **Molecular Plant Breeding** (Chair: Peter Langridge).

There is also an excellent line-up of plenary speakers including:

Professor Anthony Glass (Nitrogen transport)
Professor Cris Kuhlemeier (Genetic basis of plant-pollinator interactions)
Professor Keith Mott (Stomatal behaviour))
Professor Graham Farquhar
Dr Yong-Ling Ruan (Goldacre award winner)

Annual General Meeting of ASPS at 5-45 pm Wednesday 28th Sept in Hall A of the Adelaide Convention Centre
Finally not to be missed is the ASPS dinner on the Tuesday night.
For further details (including abstracts) see: http://www.asbmb.org.au/combio2005/

ASPS workshop for postgraduates and early-career researchers

Sunday September 25th, 2005
Plant Research Centre Auditorium, Wine and Horticulture Building
WAITE Campus, University of Adelaide

Theme 1: Tips for publishing
1:00 pm: Keith Mott (Utah State University and Editor of P,C&E)
1:30 pm: Hans Lambers (University of WA and Editor of Plant & Soil)
2:00 pm: Discussion

2:15 pm Afternoon tea/Coffee

Theme 2: Career paths: case studies
2:45 pm: Jennifer Henry (Editor, Functional Plant Biology)
2:55 pm: Mark Tester (University of Adelaide)
3:05 pm: Martha Ludwig (University of WA)
3:15 pm: Sally Bell (The Australian Wine Research Institute)

Theme 3: Tips for job applications and interviews
3:25 pm: TJ Higgins (CSIRO) - Preparing an application
3:40 pm: Steve Tyerman (University of Adelaide) - Tips for interviews
3:55 pm: Corinne Jager (University of Tasmania) - The view from the 'hot seat'

4:05 pm: Summary and General Discussion led by Steve Tyerman (Pres. ASPS).
4:30 pm: Close followed by Drinks (Adelaide University Wine), and food.

Functional Plant Biology

Spring 2005 Update

Vegemite tasting a hit at ASPB 2005 in Seattle:

I recently attended the ASPB meeting, 'Plant Biology 2005', in Seattle, to represent CSIRO Publishing in general and FPB in particular. The 'Australian food tasting' went down well. It is hard to compete with the major publishers who have so many costly gifts to give away (Blackwell memory sticks and 5-colour highlighter pens, *Plant Physiology* glossy posters, *Plant Cell* mints, Springer cotton carry bags, *Plant Journal* mugs...) but the rumour that a Vegemite tasting was on offer actually brought people over to the FPB stand! Once they were busy chewing on a Vita Wheat, I had a 30-second window to talk about FPB.

Some Australian delicacies on offer at Plant Biology 2005 in Seattle.

The FPB Best Paper Award:

We are pleased to offer our annual **Best Paper Award** for the best paper published in the Journal in each calendar year. The award carries a prize of a personal one-year print+online subscription to **FPB**, and a $250 book voucher from **CSIRO** PUBLISHING.

All ASPS members are eligible for the prize, and reviewers are asked to nominate whether a manuscript is suitable for consideration. Papers nominated for the award will be judged by the journal's Editorial Advisory Committee, and the winner of the award will be announced in an early issue of the journal each year. Last year's winner ***Megan Lindsay*** is still enjoying a huge number of downloads for her paper '**A locus for sodium exclusion (*Nax1*), a trait for salt tolerance, mapped in durum wheat**' with co-authors Evans Lagudah, Ray Hare and Rana Munns. A free PDF is available at http://www.publish.csiro.au/nid/102/aid/2285.htm. As part of the award, Megan gives a talk on her work at ComBio this year.

Send us your best papers to be in the running for this exciting award!

See you at ComBio:

As usual, FPB will have a stand at ComBio, and I will bring plenty of sample issues of the journal, and a few of our new plant science books. It helps us all to be able to put a face to a name, so come over and say hi! I also have the pleasure of presenting Yong-Ling Ruan with this year's **Goldacre award**.

I am also 'Exhibit A' in the 'Career Path: Case Studies' session if the workshop for post-graduates and early-career researchers on the Sunday afternoon at Waite (run by Tim Colmer) so come along if you want to hear about breaking into science publishing, and also for a rare chance to see photos of me having my ribs crushes by a sheep shearer or trapping one of my lecturers in a pasture cage.

I look forward to seeing you all soon!

Dr Jennifer Henry
Managing Editor

Jennifer Henry teaching daughter Rose to read.

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.

Model Legume Congress, Pacific Grove, USA

5th to 9th June, 2005
Report by Paul Scott and Pick Kuen Chan
ARC Centre of Excellence for Integrative Legume Research
The University of Queensland, St Lucia QLD 4072

The venue for the 2005 Model Legume Congress was the Asilomar Conference Grounds in Pacific Grove, California. Those with some knowledge of the short history of recombinant DNA technology will know the significance of this sight. In February 1975 it was the venue for a meeting of eminent scientists of the day to discuss the potential problems to be faced with this burgeoning technology. The Model Legume Congress was initially to be a meeting for researchers working on the model legume *Medicago truncatula*. While the meeting was dominated by presentations on work with *M. truncatula*, enough interest was shown by scientists working on other legumes that the meeting was expanded to research on other model legumes including *Lotus japonicus* and soybean (*Glycine max*). Interestingly, soybean is now widely regarded as a model legume. Around 180 delegates attended this conference, mostly from North America and Europe, but also strong representation from Japan, China and Australia.

The Asilomar Conference Grounds were built in the early part of the 20th century as part of a venture by the YWCA, with the characteristic timber and stone buildings set amongst the pine trees and sand dunes of the beautiful Monterey peninsula. The congress brought together most of the major model legume research groups with both oral and poster presentations over the five days. Presentations covered many areas but were focused primarily on nodulation and mycorrhizal interactions, transcript profiling and large scale DNA sequencing, and the evolution of legume genomes. Most of the oral presentations took place in "the Chapel" of the congress venue, which was noted as ironic by Randy Shoemaker from Iowa State University during his talk on the "Evolutionary relationships of complex genomes". The field of legume research is benefiting from recent advances in molecular biology techniques, as was evidenced by the large amount of data presented from microarray and real-time PCR studies, and the progress that has been made on the genome sequence of *L japonicus* and *M. truncatula*.

It is obviously difficult to summarise all the talks and posters that were presented over the four days. However, there were some excellent talks and posters worthy of note. Michael Udvardi from the Max Planck Institute of Molecular Plant Physiology, Golm, Germany, presented an excellent

talk on the "Whole-genome analysis of transcription factors by high-throughput QRT-PCR". While microarray technologies are providing extensive data on changes in legume gene expression during particular developmental and/or treatment regimes, it is quantitative or real-time PCR that ultimately validates microarray data. In his talk Michael clearly demonstrated the added advantage of real-time PCR over microarray analysis, which is much higher sensitivity when measuring transcript levels. Further, this talk was an excellent example of where the high throughput techniques of real-time PCR combined with powerful bioinformatic tools for designing vast numbers of primer pairs can help identify and characterise the transcription factors involved in aspects of legume biology.

Genetic analysis of the development and regulation of legume nodules was the subject of some interesting presentations. Jeanne Harris from the University of Vermont presented work on the newly described gene from *M. truncatula*, *latD*, which is required for nodule and lateral root development. In *latD* mutant plants nodule and lateral root development is initiated but subsequently arrested. Mutants also show disorganisation of the primary root meristem and disruption in the development of infecting rhizobia. Julie Frugoli from Clemson University described some recently characterised genes involved in the regulation of nodule number in *M. truncatula*. These genes included *Rlp1*, encoding a receptor like protein, 95% identical to the previously characterised *sunn*. It was proposed that just as *sunn* is a homologue of *clv1*, *Rlp1* may be a homologue of *clv2*. Other genes described were *lss* (like *sunn* supernodulator), a putative interacting partner of *sunn*; *rdn*, which complements the *sunn* mutation but by grafting is a root determined control of nodulation; and *rae*, a suppressor of supernodulation that restores autoregulation of nodulation.

The early events in symbiosis were described based on two mutants of *M. truncatula*, nsp1 and nsp2, by Giles Oldroyd's group from the John Innes Centre and Patrick Smit of Ton Bisseling's group. These mutants exhibit calcium-spiking but not the induction of gene expression that lead to nodule development. Map-based cloning of mutant alleles was used to identify both NSP1 and NSP2 as putative transcription factors of the GRAS gene family. Both NSP1 and NSP2 are nuclear proteins with NSP1 being expressed constitutively in transformed roots while NSP2 undergoes relocalization from the nuclear envelope to the nucleus after Nod factor elicitation. This leads to the speculation that MtDMI3 encoding calcium/calmodulin-dependent kinase (CCaMK) may interact with NSP1 and/or NSP2 as CCaMK may activate them and lead to downstream gene activation.

In his talk, David Bird from North Carolina State University presented data suggesting commonality between nodulation and root-knot nematode infection of legumes. Parallels between the two plant-microbe interactions include, the induction of root hair branching, the perception of a diffusible signal prior to root host penetration, and the reorganisation of microtubules. David proposed that the diffusible signal in root-knot nematode infection be called "Nem factor", with obvious links to the Nod factor of nodulation.

Aphid resistance in the model legume, *M. truncatula* was presented by Karam Singh of CSIRO Plant Industry. This group explored the availability of nuclear and biochemical resources in both legume and non-legume crops. Their work focused on resistance to *Acyrthosiphon kondoi* (bluegreen aphid) in cultivar Jester, near isogenic with the susceptible cultivar Jemalong. They have identified three modes of resistance to *A. kondoi* in Jester: antixenosis, antibiosis and

tolerance. AKR (*Acyrthosiphon kondoi* resistance), a dominant gene conferring resistance to a broad range of agricultural pests was identified and mapped. Identification and characterization of other aphid resistance genes in *Medicago truncatula* is in progress.

Leila Tirichine, from Jens Stougaard's group at the University of Aarhus in Denmark presented work on the isolation and characterization of spontaneous nodulation mutants of *L. japonicus*. The screening of more than 12 000 EMS generated lines produced 6 real mutants, with spontaneous nodules visible 10 days post germination. Nodulation is not suppressed by rhizobia, however, nitrate inhibits nodulation. Grafting studies showed that the spontaneous nodulation was a root derived phenotype. This group is currently undertaking a map-based cloning approach to identify and characterise the genetic locus. The outcomes of this study will no doubt contribute further to our understanding of the nodulation of legumes.

The conference was organised by Doug Cook from the University of California, Davis, and Julie Frugoli, with help from staff and students from UC Davis. It was fortunate that one afternoon was set aside for delegates to enjoy the local region. Many enjoyed the towns and villages nearby Pacific Grove, in particular the charming town of Monterey, famous for its "Cannery Row", as the home of John Steinbeck and for the wonderful aquarium. Both Doug and Julie and their volunteers put together what in the end was a stimulating and convivial conference in a picturesque coastal setting.

IP Roots & Branches

I am often reminded that many of the things we patent attorneys take for granted are not always second nature to people working outside the compact would of intellectual property. So, before launching into too much detail in my articles, I would like to outline some preliminary points on the various types of intellectual property introduced in my first article.

PATENTS

- Patents are concerned with the way things work.
- A granted Patent provides a monopoly for an invention for a maximum of 20 years.
- Patents are granted by the government as an incentive for introducing a **new** invention into the community.
- The invention must be new and inventive.

WHAT CAN BE PATENTED?

- Almost anything which is new and inventive and provides a workable solution or improvement to a problem.
- A full description of the invention must be provided which would allow a reader of suitable skill to reproduce the invention.
- At least one example should be given for the best method of performing the invention.

HOW IS A PATENT OBTAINED?

- A patent specification must be prepared, usually by a qualified Patent Attorney. The Patent Attorney will want to know the background of the invention, the problems solved by your invention and exactly how your invention solves those problems.
- The specification is then filed at the Patent Office and goes into a queue to be looked at by a Patent Examiner. The Examiner will review the specification and issue a report advising if the invention is new and clearly described. The specification can be changed to fix some problems and only when the Examiner is satisfied that the invention is new and fully described will the application be "accepted".
- If the Examiner is not satisfied with the above, the application may be refused.

WHEN SHOULD A PATENT BE FILED?

- **Before** any public disclosures, or sales or even an OFFER for sale of the invention.
- When you believe the invention is sufficiently developed to solve the problem at hand and when you have enough details to explain how your invention will work to your Patent Attorney.
- Once you file an application a time clock will begin ticking; BUT don't wait too long before filing or seeing a Patent Attorney…. someone else may file for a similar invention or make public disclosure of something similar and deprive your invention of novelty.
- Multiple applications can be filed as an invention develops.

TRADE MARKS

- Are concerned with branding and can comprise any "sign" which is distinctive of the goods or services supplied by the trade mark owner.
- A registered trade mark provides an exclusive right for the owner to use the mark on the goods and/or services for which it is registered.
- Trade Marks are NOT the same as business or company names.

WHAT CAN BE REGISTERED?

- The most common trade marks are words and logos; but even colours, sounds, smells and shapes can be registered as trade marks.
- The trade mark must be distinctive and not owned or used by anyone else for the same goods and services for it to be validly registered.

HOW IS A REGISTERED TRADE MARK OBTAINED?

- A representation of the mark is filed at the Trade Marks Office along with a statement of goods or services.
- The application is examined by a trade marks examiner who will check earlier applications and registrations for any conflict. The examiner will also report on the distinctive nature of the mark.
- Once the examiner is satisfied that your mark is registrable your application will be accepted.

WHEN SHOULD A TRADE MARK BE FILED?

- As soon as you decide on your trade mark, and determine that no one else is using the same or similar mark, an application should be filed.

DESIGNS

- Are concerned with the way things look, rather than how they work.
- A registered Design provides a monopoly for a limited period (16 years in Australia).
- The design must be new and original.

WHAT CAN BE REGISTERED?

- Most articles with a 3 dimensional shape.
- Most articles with a new pattern or ornamentation applied to a 2 dimensional article.

HOW IS A REGISTERED DESIGN OBTAINED?

- Representations of the article, which fully and clearly show what all views of the article look like (photos will do, but good line drawings are best) are filed at the Designs Office, again your patent attorney is best able to assist you here.
- The application is examined by a Designs Examiner. If the Examiner is satisfied that the design is new and original it will be registered.

- If the Examiner believes the design is not new or original; for example, if the article is very similar to an existing product or registration and is only different in matters which are common in the trade, the application may be refused.

WHEN SHOULD A DESIGN BE FILED?

- BEFORE **any** public disclosures of the article or sales or even **offers** for sale of the article.
- As soon as the final shape is decided. This should account for manufacturing issues and marketing (things can change dramatically when manufacturing requirements are considered).

COPYRIGHT

- Copyright is principally concerned with literary and artistic works but does have a very broad scope which may overlap with other rights.
- The work must be original, as distinct from novel.
- Copyright generally lasts for the life of the author plus 50 years.
- Copyright does not reside in tangible things, but concerns the right to COPY a work. If a painting is sold, the copyright remains with the artist.

WHAT CAN BE PROTECTED BY COPYRIGHT?

- Literary works; Dramatic works; Musical works; Artistic works; Sound recordings; Films; etc.

HOW IS COPYRIGHT OBTAINED?

- Copyright rights happen "automatically" once an author creates a work. There is no need, or even any provision, for formally applying to "register" copyright. The USA is an exception to this.
- However, in order to establish copyright right in foreign countries, particularly the USA, it is necessary to use the © logo in conjunction with the authors name and year.

TRADE SECRETS

- Trade secrets are a type of Intellectual Property where an invention is simply kept secret, so that no unauthorised person can copy the invention.
- Of course, such secrets only work if the invention cannot be reverse engineered or worked out by taking the invention apart. Chemical compositions or new methods of manufacture can sometimes be kept secret. The Vegemite™ spread or Coca-Cola™ drink are two examples.

BENEFITS OF TRADE SECRETS

- The secret remains unavailable to the public so long as it remains a secret. Patents on the other hand expire after 20 years.
- Trade secrets do not cost money to secure.

DISADVANTAGES OF TRADE SECRETS

- The secret can get out and all rights will be lost. Secret use, prior to filing a patent, will invalidate a patent (you can't have your cake and eat it too).
- Trade secrets must be vigilantly maintained and all personnel involved must be completely trusted. Trade secrets are difficult to police.
- Competitors may find other ways of achieving your results.
- Trade secrets are difficult to license, as they must be disclosed. The value of trade secrets is diluted as more people get to know them.

WHY SHOULD I PROTECT MY INTELLECTUAL PROPERTY?

- To protect against unauthorised copying and theft.
- To provide a deterrent for possible infringers.
- To provide a licensing tool to help market and possible sell the Intellectual Property.
- To provide a tool for litigation if infringement occurs.
- To establish a commercial advantage.

Mark Wakeham
Patent and trade mark attorney
FB Rice & Co
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Did you know....?

- ***Discipline Representatives***. Discipline representatives in ASPS serve on the ASPS council for a period of two years. Nominations are called to replace the retiring discipline representatives in the fields of "Whole Plants", "Environmental and Ecophysiology", "Global Warming" and also a Student Representative. Please see the nomination forms in a recent e-mailout from John Patrick (*ASPS secretary*). Completed forms need to reach John by no later than noon of September 27. Prior to September 23, completed nomination forms can be Faxed to him on 02 49 21 6923. Thereafter please pass completed forms to John during ComBio.

- ***ASPS Website.*** The ASPS website is regularly updated. We'd like to remind you that if you wish to advertise jobs, PhD scholarships, conferences, books, etc. you can contact Lidia Mischis via advertise@plantsci.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***.

- ***Student Travel Funds.*** Funds are set aside each year to sponsor student travel to our annual conference (this year in Adelaide), and in this way 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.

- ***Life and Corresponding 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 Us" where there is also a list of Life and Corresponding members).

- ***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 in each conference will be about $2500. Funds will be awarded upon the following conditions:

1. The society will be promoted as sponsor of the meeting.
2. The society will be refunded the $2500 or part thereof from any profits made from the conference meeting.
3. The conference organisers will provide a budget for the meeting.

Each application will be considered by the Executive Council on its merits but the conference proposed should fulfil the following criteria:

(i) the conference should support the activities of Australian plant scientists.
(ii) the conference organisers should provide proof that they are applying for funds from other organisations and are supporting the active participation of post-graduate and honours students in the meeting.
(iii) the conference organisers should provide a financial summary after the meeting to the Society.
(iv) after the meeting, the conference organisers will prepare a report to be published in *Phytogen*.

TWIGS & BRANCHES

Some News & Comments from the Plant Science World

The auxin receptor

How auxin is perceived has been a question puzzling plant scientists for over a century. Dharmasiri *et al.* 2005 (*Nature* **435**: 441-5) and Kepinski & Leyser (*Nature* **435**: 446-51) have provided part of the answer. Auxins can rapidly modulate gene expression by promoting degradation of the Aux/IAA transcriptional repressors by the ubiquitin-ligase complex SCF^{TIR1}. Using pull-down and binding assays these groups show that auxin directly promotes the Aux/IAA-SCF^{TIR1} interaction by binding to TIR1 indicating that TIR1 is an auxin receptor mediating transcriptional responses to auxin. This is a novel method of regulating the SCF-target interaction as the signal (auxin) binds directly to the F-box protein, TIR1. In other eukaryote systems, phosphorylation typically plays a role in triggering activation of the SCF complex. Interestingly plants contain large numbers of F-box proteins (e.g. > 700 in Arabidopsis) and the SCF-based mechanism of signalling may play a major role in plant responses to the environment.

Dragon – a new search tool

The advent of systems biology means that researchers need to rapidly become familiar with vast amounts of existing data about genes/gene products revealed in their system. Bajic *et al.* 2005 (*Plant Physiol* **138**: 1914-25) report on a text mining tool that they have developed that will search PubMed abstracts to integrate information on Arabidopsis genes and biochemical functions and build up a network of associations. The search tool is easy to use and forms an excellent starting point in for systems based analysis. Since the input data is PubMed abstracts, the output networks are only tentative associations and their biological validity will need to be confirmed experimentally.

Rhizosphere costs & benefits

Plant microbe interactions in the rhizosphere are immensely important to both the plants and microbes to maintain their health. Morgan *et al.* 2005 (*J Exp Bot* **56**: 1729-39) analyse the carbon loss from plants that sustains microbial enrichment in the rhizosphere and discuss how this carbon loss benefits plants through enhanced nutrient cycling, hormone production, disease and toxic compound tolerance.

Walls of water

Apoplastic water is found in the cell walls and xylem elements. How water and solutes partition between the apoplast (extracellular) and symplast (cellular) components is an important consideration in measuring cell turgor. The amount of apoplast water can vary considerably within and between species. In a recent study Wardlaw 2005 (*Funct Plant Biol* **32**: 561-9) showed that leaf apoplast water content ranged from ~15-30% of total leaf water. These findings impact on cell turgor measurements based on analysis of frozen/thawed tissue.

Helen Irving

UPCOMING CONFERENCES

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ComBio2005

Adelaide Convention Centre 25 Sep to 29 Sep 2005
For further information: contact Steve Tyerman
(stephen.tyerman@adelaide.edu.au)
or Brent Kaiser (brent.kaiser@adelaide.edu.au)
or Kathy Soole (kathleen.soole@flinders.edu.au)

or go to:
http://www.asbmb.org.au/combio2005/program.html

Forum for Postgraduate Students and Early-Career Researchers

(Proudly presented by the ASPS council)

Date: Sunday 25 September 2005

Venue: Waite Campus, University of Adelaide

To register your attendance, please email: tdcolmer@cyllene.uwa.edu.au

15th Biennial Australasian Plant Pathology Society Conference

Geelong, Victoria in September 2005.

More information can be found at: www.deakin.edu.au/events/APPS2005

2nd Annual ACPFG Research Symposium Genomics in the Barossa

Clare Valley, South Australia
7-11 November 2003
Further information at: www.acpfg.com.au

ISPMB

8th International Congress of Plant Molecular Biology

20–25 August 2006

Adelaide Convention Centre, Adelaide, Australia

http://www.sallyjayconferences.com.au/ispmb2006/

Photosynthesis in the Post-Genomic Era: Structure and Function of Photosystems

(In honour of Professor James (Jim) Barber)

20–26 August 2006

Pushchino, Moscow Region Russia

More information is available at: http://psmeeting.ibbp.psn.ru/