PHYTOGEN

A
NEWSLETTER
FOR
AUSTRALIAN
PLANT SCIENTISTS

Volume 5 Number 2
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PHYTOGEN

Volume 5: Number 2

INSIDE THIS ISSUE

A big thanks to all the scientists out there 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....

getting down to the grass roots

In the 2.5 years that we have been putting Phytogen together we have seen it progress from a hard-copy document that was quite costly in terms of print production to a pdf file uploaded onto the website and sent to members via email. Changing to the pdf format gave us much greater flexibility in terms of timing of production, distribution and content. In an attempt to try and enhance services to the members, we introduced columns that reviewed the world of plant science (Twigs and Branches) as well as a look at research on a stately basis (State of Affairs). Thus far, we have seen research from NT, Qld, WA, SA, Tas, Vic and NSW covered (ACT is due in the next Phytogen). The contributions we do receive from members (sometimes after much nagging!) help towards making Phytogen what it is. The comments and feedback we have received for Phytogen have been nothing short of positive giving us a great sense of satisfaction. So thankyou to all our contributors. We would also like to say Phytogen is only possible because of the contributions we receive and so the more you want to share with your colleagues, the better Phytogen is!

However, mainly due to other commitments we hereby formally resign from the positions of co-editors of Phytogen for the Society. We wish the Society well in finding new editor/s of Phytogen and hope that we continue to benefit from being a part of the Society.

Amanda & Jason Able

Focusing on one state's research per edition

This edition:

NEW SOUTH WALES

Editors' note: We approached 35 members from 25 research groups across New South Wales and only 2 were received!

The Biosynthesis of Abscisic Acid

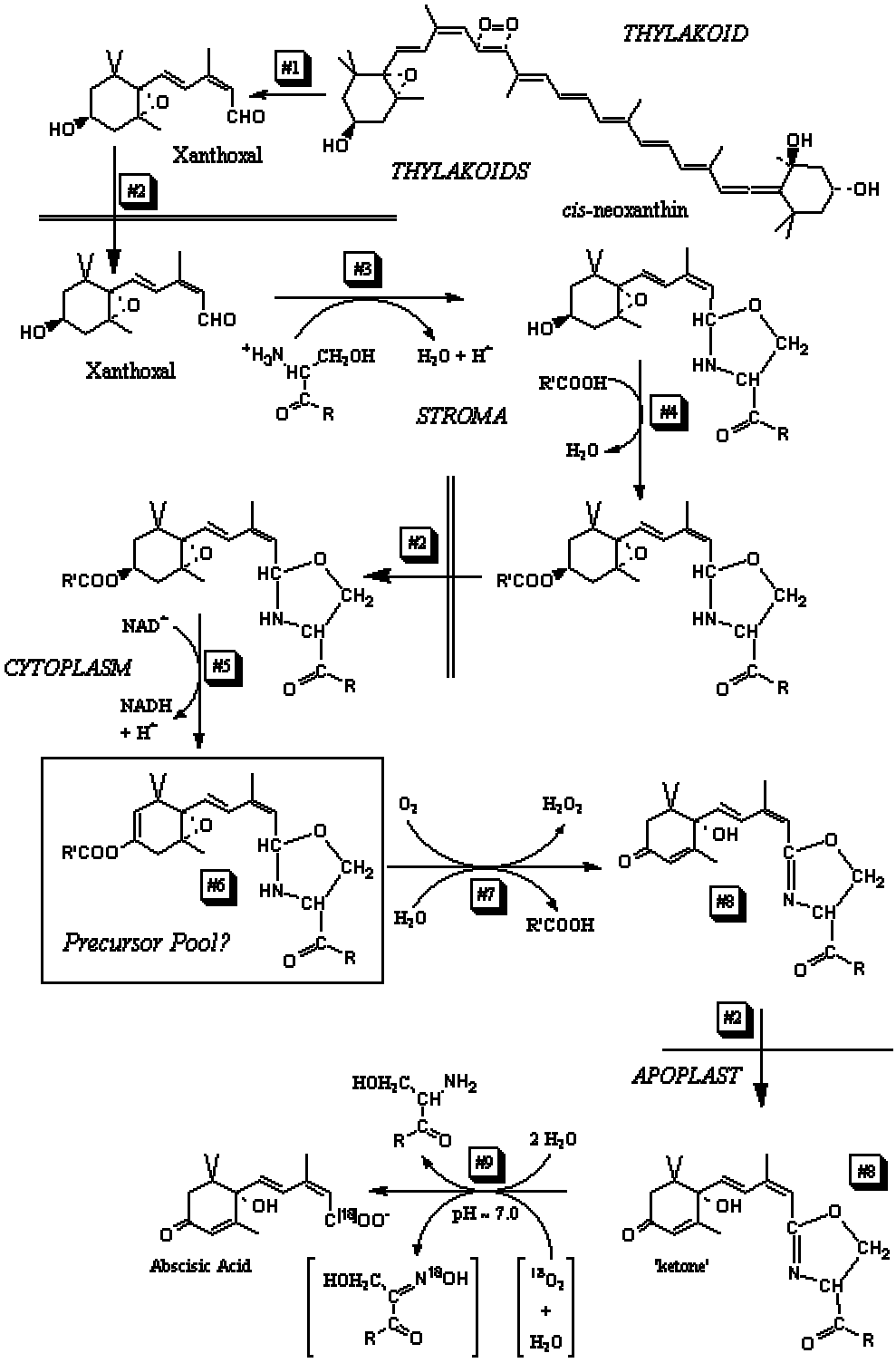
A.G. Netting & Brett Neilan

School of Biotechnology and Biomolecular Science, University of New South Wales, Sydney, 2052.

E-mail: A.Netting@unsw.edu.au

The Figure outlines our current hypothesis for the biosynthesis of the plant stress hormone, abscisic acid (ABA). This differs from published versions (*e.g.* Schwartz *et al. Science* (1997) **276,** 1872-4) principally in that both the aldehyde and secondary alcohol groups of xanthoxal are shown as being derivatised with small peptides. We believe that these peptides protect cellular constituents from attack by these groups, particularly the aldehyde. We have some evidence that the R group at the future carboxyl of ABA contains histidyl residues and is probably a tripeptide – a tetrapeptide with the seryl residue shown at the future carboxyl. The R' substituent at the future ketone of ABA is about the same size as the substituent at the future carboxyl and our present data is consistent with it being a similar peptide. We have identified compound #8 in xylem sap and assayed compound #6 as ABA-aldehyde but the latter seems to be readily oxidised by atmospheric oxygen so that it has, until now, been mis-identified as various isomers of compound #6 with a double bond from the future carboxyl carbon to the peptide nitrogen.

We are at present attempting to isolate compounds #6 and #8 so that the sequence of the peptides can be determined. We are also looking for evidence that H_2O_2 is indeed produced from O_2 by aldehyde oxidase (#7) because H_2O_2 is a signalling molecule that opens Ca^{2+} channels, at least in guard cells (Pei *et al.* (2000) *Nature* **406,** 731-4), and probably changes the cell's metabolism towards the 'stress tolerant quiescent state' (Netting, *J. Exptl. Bot.* (2000) **51,** 141-58; (2002) **53,** 151-73). It is also a possibility that aldehyde oxidase (#7) may oxidise exogenous aldehydes and simultaneously open this Ca^{2+} channel, thus protecting the cell from aldehydes. Further, we are entertaining the idea that a pair of histidyl residues in each of the substituent peptides could complex O_2 when positively charged so that precisely the correct amount of O_2 would be removed from the stroma for the final release of ABA in the apoplast.


THYLAKOID
THYLAKOIDS
cis-neoxanthin
Xanthoxal
#1
#2
#3
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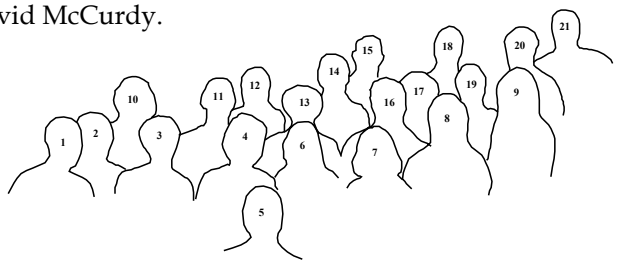
#8
#9
STROMA
CYTOPLASM
Precursor Pool?
APOPLAST
Abscisic Acid
'ketone'
pH ~ 7.0
2 H2O
NAD+
NADH
+ H+
R'COOH
H2O2
O2
H2O

Plant Science Group
School of Environmental & Life Sciences,
The University of Newcastle

Professor John Patrick, Associate Professor Tina Offler, Associate Professor Ray Rose, Dr David McCurdy, Mike Cole, Dr Xin-Ding Wang, Kevin Stokes, Agnes Kovacs, Dr Carmen Castor, Dr Yuchen Zhou, Kim Nolan, Nikki Legge, Stephen Dibley, Michael Sheahan, Nasir Saeed, Rina Irwanto, Yvonne Nussbaumer, Katie Owyong, Mark Talbot, Nigel Fisher, Trimurti Wardini, Mark Burns, Deborah Landenberger, Kate Shearston, Nathan Setz, Kim Dibley, Daniel Daniher, Xiao Yang and Emma Gabrielsson,

Research outputs of the Plant Science Group contribute to understanding key plant processes that underpin plant growth and development. Of paramount significance is our work on nutrient acquisition and transport. These studies are strategically positioned to provide an information platform for biotechnological innovation aimed at optimising crop productivity in stressful environments. These innovations will allow the development of more efficient and sustainable cropping systems resulting from increased nutrient and water use efficiencies. At the regional level this knowledge is being applied to mined-land rehabilitation and sustainable nutrient cycling in the management of ecosystems.

A recent Group photograph: 1. Kate Shearston, 2 Mike Cole, 3 Yvonne Nussbaumer, 4 Tina Offler, 5 Michael Sheahan, 6 Katie Owyong, 7 Rina Iwanto, 8 Yuchen Zang, 9 Xiao Yang,10 Nathan Setz, 11 Nigel Fisher, 12 Kevin Stokes, 13 Kim Dibley, 14 Mark Talbot, 15 Stephen Dibley, 16 Nasir Saeed, 17 Nikki Legge, 18 Daniel Daniher , 19 Kim Nolan, 20 John Patrick, 21 David McCurdy.



Nutrient Transport in Developing Seeds and Fruits

The goal of this program is to understand the regulation of nutrient (amino acids, ions and sugar) transport in sinks (net importers of nutrients). Mechanisms regulating membrane transport are being discovered using developing seeds (grain legumes; cereals) and fruit (tomato) as experimental models. In these organs there are mandatory membrane transport steps to and from the cell wall space during nutrient transit from the phloem (nutrient delivery tissue) to storage cells (see review by Patrick & Offler, 2001). For developing seeds, the program aims to identify inductive signals and processes regulating transfer cell development. These cells have invaginated walls (wall ingrowths) that amplify plasma membrane area to enhance transport of nutrients (see review by Offler *et al.* 2003).

Transporters in developing seeds and fruits. Our research focuses on discovering membrane proteins responsible for transporting nutrients to and from the sink apoplasm, their physiological significance and how their transport activities are regulated. Most progress has been made with sugar uptake from the sink apoplasm. Sucrose (pea cotyledons – Tegeder *et al*. 1999) and hexose (tomato fruit – Gear *et al*. 2000) transporters have been cloned and functionally characterised as proton symporters. Some indication of the physiological significance of sucrose symporters has been obtained by finding that their overexpression in developing pea cotyledons enhances sucrose uptake and to a lesser extent cotyledon growth rates (Rosche *et al*. 2002). Currently, another transgenic line of pea and a number of tomato transgenics, all with altered transporter expression, are being evaluated. The role of sugars in integrating metabolism with membrane transport is being explored using *in vitro* cultured cotyledons and an isogenic mutant of pea with a metabolic lesion in starch biosynthesis. Sucrose release from maternal seed tissues is in part mediated by proton antiport regulated by cell turgor (Walker *et al*. 2000) while non-selective channels support efflux of ions (Zhang *et al*. 2002). Recently initiated projects are attempting to clone sucrose effluxers and non-selective channels from bean seed coats in collaboration with Professors Frommer (Stanford, USA) and Tyerman (Adelaide) respectively. In addition, a productive collaboration with Dr Furbank (CSIRO, Plant Industry) is examining roles of sucrose transporters in developing cereal seeds (Aoki *et al*. 2002).

Transfer cells. We are continuing our program exploring the regulation of transfer cell development. Our novel experimental system for manipulating transfer cell induction in Faba bean cotyledons (Farley *et al*. 2000) and Scanning EM techniques (Talbot et al 2001) to image the 3-dimensional structure of wall ingrowths are the platform for our experimental approaches. We have established that wall ingrowths of Faba bean cotyledon transfer cells initiate as papillate projections before branching and fusing into fenestrated layers of wall material (Talbot *et al*. 2001). The plasma membrane adjacent to wall ingrowths is enriched in sucrose transport-associated proteins (Harrington et al 1997) and TEM immunogold localization to determine the spatial relationship of wall ingrowth components (undertaken in collaboration with Dr Kevin Vaughn (USDA, Mississippi USA)), indicate concentration of arabinogalactan proteins (AGPs) at the leading edges of developing wall ingrowths. These observations have provided a base to develop a hypothetical model for the differentiation of a functional transfer cell (Offler et al 2003). We are currently testing our model by exploring regulation of wall ingrowth architecture and addressing the question of the inductive signalling cascade. Evidence to date suggests that wall ingrowth architecture is independent of the microtubule cytoskeleton, but that cellulose microfibril deposition is essential to establish initial papillate wall projections. (The latter work has been done in collaboration with Dr Geoff Wasterneys, RSBS, ANU). In terms inductive signalling, recently we have established that induction occurs very rapidly, within minutes, and that sugars are an integral component of signalling transporter expression and function, but are not required to induce wall ingrowth deposition. All of these studies are ongoing.

Aoki N, Whitfield P, Hoeren F, Scofield G, Newell K, Patrick J, Offler C, Clarke B, Rahman S & Furbank RT, 2002. Three sucrose transporter genes are expressed in the developing grain of hexaploid wheat. *Plant Molecular Biology* **50**, 453-462.

Farley SJ, Patrick JW & Offler CE, 2000. Functional transfer cells differentiate in cultured cotyledons of *Vicia faba* seeds. *Protoplasma* **214**, 102-117.

Gear M, McPhillips M, Patrick JW & McCurdy DW, 2000. Hexose transporters of tomato: molecular cloning, expression analysis and functional characterization. *Plant Molecular Biology* **44**, 687-697.

Harrington GN, Nussbaumer Y,. Wang X-D, Tegeder M, Offler CE, Patrick JW, Franceschi VR & Frommer WB. 1997. Temporal and spatial expression of plasma membrane sucrose transport-related genes in cotyledons of *Vicia faba* L. *Protoplasma*. **200**, 35 - 50.

Offler CE, McCurdy DW, Patrick JW, Talbot MJ 2003 Transfer cells: Cells specialized for a special purpose. *Annual Review of Plant Biology* **54**, 31-55.

Patrick JW & Offler CE, (2001). Compartmentation of transport and transfer events in developing seeds. *Journal of Experimental Botany* **52**, 551-564.

Rosche E, Blackmore D, Tegeder M, Richardson T, Schroeder H, Higgins TJV, Frommer WB, Offler CE & Patrick JW, 2002. Seed-specific expression of a potato sucrose transporter increases sucrose uptake and growth rates of developing pea cotyledons. *Plant Journal* **30**, 165-175.

Talbot MJ, Franceschi VR, McCurdy DW & Offler CE, 2001. Wall ingrowth architecture in epidermal transfer cells of *Vicia faba* cotyledons. *Protoplasma* **215**, 191-203.

Tegeder M, Wang X-D, Frommer WB, Offler CE & Patrick JW, 1999. Sucrose transport into developing seeds of *Pisum sativum* L. *Plant Journal* **18**, 151-161.

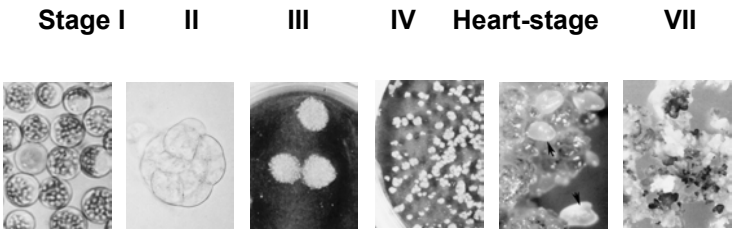
Zhang W-H, Skerrett M, Walker NA, Patrick JW & Tyerman SD, 2002. Non-selective channels in plasma membranes of protoplasts from coats of developing seeds of bean. *Plant Physiology* **128**, 1187-1196.

Walker NA, Zhang W-H, Harrington G, Holdaway N & Patrick JW, 2000. Effluxes of solutes from developing coats of *Phaseolus vulgaris* L. & *Vicia faba* L.: Locating the effects of turgor in a coupled chemiosomotic system. *Journal of Experimental Botany* **51**, 1047-1055.

Plant Cell Development

The ARC Centre for Integrative Legume Research has a primary focus on discovering molecular controls of plant development that can be exploited to better adapt agricultural plants to Australian environments. The Newcastle node of the Centre will head up studies on meristem formation during embryogenesis using *M. truncatula*. Collaborative studies on the role of the cytoskeleton (Purdue) and organelle inheritance (ARC Centre) in plant development are underway.

Development of meristems from single isolated plant cells in M. truncatula *M. truncatula* is a model legume whose genome is being completely sequenced. The ability to regenerate plants from individual cells provides a unique *"stem cell"* system for studying meristem formation in embryogenesis (Rose and Nolan, 1995). The *M. truncatula* line 2HA is a gain of function mutant which has a 500 fold greater capacity to regenerate plants from mesophyll protoplasts in culture by somatic embryogenesis than its near-isogenic progenitor line Jemalong (Rose *et al*.1999). Hence the comparison of Jemalong with 2HA provides ideal material to investigate the mechanisms of meristem formation in somatic embryogenesis in legumes and can also lead to improved protocols for legume regeneration and legume transformation. The first appearance of embryos from mesophyll protoplasts of 2HA occurs between 5 to 7 weeks and has a reasonable degree of synchrony, thus enabling a developmental study of the molecular changes taking place. Seven stages have been documented during the regeneration of isolated mesophyll protoplasts (I) (See Figure below).



Stages of legume embryo development initiated from single totipotent somatic cells. Colonies from individual cells (II); microcalli (III); small calli (IV); globular embryo (V); heart-stage embryos (HSEs; VI); and plantlets forming from HSEs (VII). During transition through these stages there are changes in the organisation of cellular proliferation as a HSE is formed with separate root and shoot meristems.

Gene expression and RNAi studies of individual genes is being carried out at these different developmental stages as well as global analysis using microarrays (with K.VandenBosch's 16K *M. truncatula* microarray – U. of Minnesota) and proteomic studies (with B.G.Rolfe -ANU) in conjunction with bioinformatics. These systems biology approaches are being related to a detailed histological atlas of the above developmental sequence. The gene networks found to act in meristem development *in vitro* will be related to the control of meristem development in producing the architecture of the intact legume plant, being pursued in the three other CILR nodes at the Universities of Queensland and Melbourne, and the ANU.

The role and mechanism of action of the SERK gene family in in-vitro embryogenesis. The MtSERKI gene is up-regulated by auxin early in the culture of *M. truncatula* tissue and roots are produced. Cytokinin potentiates the auxin response and in the Jemalong 2HA genotype embryos are produced (Nolan et al., 2003). The nature of the ligand that interacts with MtSERK1 is unknown and there is limited knowledge of the downstream signalling events. Biochemical and RNAi studies are being undertaken to investigate these latter phenomena. Phylogenetic analysis suggests MtSERK1 is orthologous to AtSERK1 but its developmental role appears to be different. However as in Arabidopsis there appears to be four other SERKs, and these are also being investigated in embryogenesis. CLAVATAI is another LRR-RLK that is expressed in in vitro embryogenesis and its role here is being contrasted with that in nodulation and meristem development. These LRR-RLK studies are being directed to an integrated understanding of their role in plant development.

Biochemical and genetic analysis of the fimbrin family of actin-binding proteins in Arabidopsis thaliana. This project is using molecular and genetic approaches to understand how the family of five fimbrin actin-binding proteins in Arabidopsis participate in cytoskeletal control of plant morphogenesis events. Our primary approach is to analyse actin-binding properties of representative members of the family by using bacterially-expressed proteins. In addition we are using promoter-reporter (GFP) gene fusions to determine expression of individual members of the family, as well as phenotypic analysis of T-DNA insertional mutants for each gene. Homozygous plants of single insertion lines are being grown under a variety of growth conditions to identify phenotypes associated with individual fimbrin knockouts. Furthermore, we are developing a suite of fusion constructs between actin-binding domains from AtFim1 and GFP and its variants to enable dynamic visualization of the actin cytoskeleton in transgenic Arabidopsis and tobacco (see below). The various tools being developed will enable detailed structural analyses of the actin cytoskeleton in genetic backgrounds lacking individual members of the fimbrin family.

Organelle inheritance in totipotent plant cells. Our research has demonstrated that organelle partitioning during plant cell division is an ordered process requiring an intact actin cytoskeleton (Sheahan, Rose, McCurdy – *Plant Journal*, in press). These findings were made using leaf mesophyll protoplasts from tobacco, and required generating transgenic tobacco expressing GFP targeted to several different organelles and the actin cytoskeleton. To expand our molecular understanding of organelle partitioning mechanisms we are continuing the tobacco studies as well as using leaf mesophyll protoplasts from "knockout" mutants in *Arabidopsis* lacking functional expression of specific genes associated with cytoskeletal and cell cycle regulation.

Gresshoff, P.M., Rose, R.J., Singh, M. and Rolfe, B.G. (2003) Symbiosis signals. *Today's Life Science* 15, 30 – 33

Nolan, K.E., Irwanto, R.R. and Rose, R.J. (2003) Auxin up-regulates *MtSERK1* expression in both *Medicago truncatula* root-forming and embryogenic cultures. *Plant Physiology* 133, 218 – 230

Rose, R.J. and Nolan, K.E. (1995) Regeneration of *Medicago truncatula* from protoplasts isolated from kanamycin-sensitive and kanamycin-resistant plants. *Plant Cell Reports* 14, 349-353

Rose, R.J., Nolan, K.E. and Bicego, L.(1999) The development of the highly regenerable seed line jemalong 2HA for transformation of *Medicago truncatula*: implications for regeneration via somatic embryogenesis. *J. Plant Physiology* 155, 788-791

Sheahan, M.B., Rose, R.J. and McCurdy, D.W.(2003) Organelle inheritance in plant cell division: the actin cytoskeleton is required for unbiased inheritance of chloroplasts, mitochondria and endoplasmic reticulum in dividing protoplasts. *Plant Journal* (in press)

Environmental Management and Rehabilitation

A strong relationship has been established with Hunter Valley coal mining companies to develop innovative strategies for ecosystem rehabilitation of mined land. New initiatives are being opened up at interfaces between fundamental plant biology and ecosystem management in areas of ecotoxicology.

Mined Land Rehabilitation. A long-term research facility and study program at Mount Owen Mine and the adjacent Ravensworth State Forest remnant is being developed with an anticipated life of 20 years or longer. It involves a large-scale forest reconstruction trial (c.a. 8 ha) with objectives that include provision of wildlife habitat. Our studies have shown that a critical problem in the Upper Hunter is a lack of nitrogen and phosphorus to support sustainable plant growth and life cycle completion. Allied investigations showed that, following extensive logging and grazing, the forest remnant has ca 10% of root-microbe associations expected in an old growth forest. These root-microbe associations are critical for sustainable nutrient acquisition and litter decomposition. Thus, a primary objective is to develop technologies for laboratory culture of these microbes and their return at levels that enable a sustainable forest to be reconstructed in both remnant and mine rehabilitation sites.

Ecotoxicology of Plants and Plant Communities The objectives of this research are to actively reduce the concentration of chromium (Cr) and arsenic (As) in the sediment and water effluent at industrial sites employing aquatic plants as a natural and environmentally sensitive remediation tool in effluent channels and holding ponds on site. A range of native test species will be assessed both in the laboratory and under field conditions for their ability to tolerate, accumulate and phytoremediate water soluble and sediment-bound Cr and As. This proof of concept project aims to develop protocols for choosing appropriate plants species for the phytoremediation of As and Cr contaminated water and sediment both nationally and internationally.

Functional Plant Biology
Winter/Spring Update 2003

ASPS/FPB co-promotion at the ASPB meeting in July

The ASPS and FPB had a joint stand at the ASPS meeting in Honolulu in July this year. There was quite an Australian turnout at the meeting, with 10 of us all up (not counting expats!). Our stand promoted 'all things Australian' in plant science, including the ASPS and benefits of membership, many of the forthcoming conferences, and a Vegemite tasting! The new ASPS banner received a great deal of favourable attention, and I would like to thank those Australians that took some time to attend the stand, including Brain Atwell who took over when Sharon Robinson, Carolyn Schultz and I abandoned him to attend the 'Women in Plant Science' lunch. Congratulations to Carolyn Schultz for winning the ASPB 'Young Scientist's Best Paper Award' for her paper, titled 'Using Genomic Resources to Guide Research Directions: The Arabinogalactan Protein Gene Family as a Test Case', published in the August issue of *Plant Physiology*.

See you at ComBio!

We are very much looking forward to seeing you all at ComBio this year. Come and meet Amanda Ellery! Amanda is the Production Editor for all the Plant Science journals, including *FPB*, at **CSIRO** PUBLISHING. She completed a B.Agr.Sci. at the University of Melbourne in 1992, before undertaking a PhD at the Australian National University. She studied the role of sulfur nutrition in regulating expression of genes encoding sulfur-amino-acid-rich seed storage proteins. In 1996, she joined Plant Industry in Perth, and studied the ecology of weed seed banks in cereal cropping systems. She joined **FPB** in 2003, and manages papers from acceptance to publication, with responsibility for copyediting, proof distribution and correction, production quality, and preparing each issue for printing.

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Did you know….?

- ***ASPS Website*** Lieve Bultynck is relinquishing these duties as she moves onto a new job. Thanks Lieve for your efforts with the website. Lidia Mischis from the School of Biological Sciences at Flinders University will now look after the website and job advertisements. The contact email for job advertisements or any other website matters is still the same: advertise@plantsci.org.au.
- **"Science meets Parliament"** is on Tuesday-Wednesday October 14-15.The event is a wonderful opportunity for scientists and technologists to put the case for science to their MPs. Among the science and research issues Parliament will soon be considering are the Higher Education Review and how the $3 billion "Backing Australia's Ability" funding package should be extended. There are currently nine reviews or inquiries in science, higher education and research. They are expected to come together at the end of this year, and determine how Australia will approach these issues in the next few years. It is an important time for science and research! HIGHLIGHTS THIS YEAR INCLUDE:
    - **A National Press Club debate between Peter McGauran and Kim Carr
    - **The Science-Industry dinner at Old Parliament House
    - **A new forum for young scientists to meet young members of Parliament

  As usual, all participating scientists will meet Parliamentarians, and have an opportunity to explain the value of their work. And the cocktail reception at Parliament House will again be hosted by the Speaker of the House, the President of the Senate and the Minister for Education, Science and Training. Articulate scientists and technologists are needed to go to Canberra to give first hand accounts to Parliamentarians of good science, and the opportunities this work creates. Members of all Societies affiliated with FASTS (such as ASPS) are invited to register at our web site: www.fasts.org

- We are pleased to announce that the Goldacre Award this year has been won by Harvey Millar, from the University of Western Australia. The applications were judged by three eminent plant scientists from Australia and Europe. The assessers remarked on the extraordinarily high quality of this year's applicants. They concurred in rating Harvey first because of his outstanding results in proteomic analysis of plant mitochondria carried our over the last three years. This demonstrates the common features of plant mitochondria and animal mitochondria, and at the same time the differences between them. Harvey's work shows flair and innovation, and the results should be regarded in future years as landmarks. Here are the comments from the three eminent and independent assessors: "All applicants were worthy of the Goldacre Award, and might have got it in other years with more 'normal' competition" "The community of the Australian Plant Scientists can be congratulated on the very high standard of research documented by all the nominations, which makes it difficult for me to decide

which is the best." "I found it very difficult to rank these applicants. There are certainly some excellent early-career plant scientists working in Australia." We thank the assessors for their hard work, and congratulate Harvey as well as the other applicants for setting such a high standard.

COMBIO 2003 UPDATE

This year our NZ colleagues will join us at the ComBio 2003 meeting in Melbourne. The meeting promises to bring together a particularly exciting mix of the latest in plant physiology to developmental biology, biochemistry and structural biology.

There will be over 20 plenary lectures and several excellent international speakers from the plant scientific community will be presenting some of their latest work during the meeting. Their talks will range from the ecophysiological perspecitve to the latest of the "-omics" topics. Oliver Fiehn from the Max-Planck-Institute will be speaking on Metabolomics while Cathie Martin from the John Innes Centre will speak on "Effective engineering of plant metabolism: Lessons from Nature". Herman Höfte from INRA Versailles will present his recent work on cell walls and cell elongation and Jen Sheen from Harvard will enlighten us about MAPK cascades and how they link sugar sensing and hormonal responses. We are also fortunate that Kevin Griffin from Columbia University (the Annals of Botany speaker) will present "Global warming at night: Linking photosynthesis, respiration and plant growth". Concurrent sessions and poster sessions will run between the plenary sessions and the organising committee has ensured that there are plenty of additional opportunities for people to catch up at tea and lunch breaks. The symposia chairs have been busy organising details of the concurrent symposia. In the "-omics" stream, the genomics of organelles and cell walls are highlighted while proteomics and metabolomics form the focus of a further session. In the plant growth and development stream, symposia deal with the important processes of nutrient acquisition, signalling, morphogenesis during development, reproduction and secondary metabolites. Further symposia examine plant responses from the whole plant and ecophysiological perspective including plant microbe interactions.

As you can see it should be an exciting meeting. There will again be an opportunity for students (who are presenting a poster or talk) to meet international speakers at the Student Lunch with Plenary Speakers.

ComBio03 represents the annual scientific meeting of five participating societies:

- Australian Society for Biochemistry & Molecular Biology (ASBMB)
- Australia and New Zealand Society for Cell and Developmental Biology (ANZSCDB)
- Australian Society of Plant Scientists (ASPS)
- New Zealand Society for Biochemistry and Molecular Biology (NZSBMB)
- New Zealand Society of Plant Physiologists (NZSPP)

TWIGS & BRANCHES

Some News & Comments from the Plant Science World

Functional traits in ecosystems

The latest issue of the *Australian Journal of Botany* (vol 51 (4)) features a paper that explores the role of plant functional traits in ecosystems and the research efforts underway to screen plant species in various biomes around the world. It features a practical handbook with step-by-step recipes, with relatively brief information about the ecological context, for 28 functional traits (such as leaf frost sensitivity, stem specific density and leaf nitrogen concentration) recognised as critical for tackling large-scale ecological questions.

Secondary metabolism

Want to know more about secondary metabolism and transcriptional regulation of its pathways? Kevin Davies and Kathy Schwinn review this topic in the latest *Functional Plant Biology* (vol 30(9):913-925). The regulation of the phenylpropanoid pathways appears to be well understood but a lot of work needs to be done in the other pathways (such as the terpenoid pathway).

Super-yielding grain mutant???

A new interesting mutation in wheat producing three pistils in a floret has been described (Peng, *Journal of Agronomy and Crop Science*, vol 189(4): 270. Usually a floret carrying only one pistil will develop into one grain after fertilisation. The 'three pistils' mutant carries three pistils in a floret with all having the potential to develop into grains.

Salt tolerance regulation

Using a yeast two hybrid system, Nagaoka and Takano (*J. Exp. Bot.* **391**: 2231-2237) have found a transcription factor that regulates a salt tolerance-related protein (STO) in Arabidopsis. Interestingly, STO is not induced by NaCl but it would seem that if constitutive expression is consistently high (as regulated by the MYB transcription factor) the plant is tolerant when exposed to salt. The authors have also shown that STO is a transcription factor for a number of other stress-related genes.

Is selenium essential?

A paper by Pilon and colleagues in the latest *Plant Physiology* (131: 1250-1257) begs the question of whether or not selenium is an essential plant nutrient (as discussed by the editor in this issue). The authors have used *Arabidopsis* overexpressing mouse selenocysteine lyase to show potential phytoremediation benefits for selenium toxicity. The interest this has generated revolves around the concept that toxicity is rarely seen in plants (indeed whether it is a nutrient that plays a role in plants is still to be established) but toxicity can be an issue in animals.

SAR with a twist

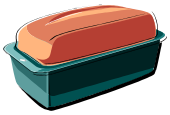
The quest to understand the mechanisms involved in systemic acquired resistance (SAR) has taken a new turn with work published by Despres et al in the latest *Plant Cell* (vol 15, Sept 2003). Després et al. show that TGA1 (a transcription factor) is present in an oxidized state in Arabidopsis leaves in the absence of SA, as manifested by the formation of a disulfide bridge between two conserved Cys residues. SA accumulation causes the reduction of these Cys residues, and the reduced form of TGA1 is capable of interacting with the major SAR regulatory protein NPR1. The interaction with NPR1 enhances the DNA binding

of reduced TGA1, which, like other members of the TGA family, binds specifically to SA-regulatory sequences found in the promoters of numerous *PR* genes in an NPR1-dependent manner.

Apomixis markers

In the August issue of *The Plant Cell*, Matthew Tucker and colleagues (from Anna Koltunow's lab at CSIRO-PI-Adelaide) (vol 15(7):pages 1524–1537) provide strong evidence that sexual and apomictic reproduction in the genus *Hieracium* are molecularly related pathways that share regulatory programs. Previous comparative morphology has hinted that the molecular mechanisms underlying the two reproductive pathways may share common elements. However, the use of reproductive molecular markers by Tucker et al. provides much needed evidence to support this view.

JASON & AMANDA ABLE



BARLEY, CEREAL CHEMISTRY, BREAD, BEER & BISCUITS

Experts in cereal chemistry and members of the barley industry (researchers, breeders, growers and granting bodies) converged on the seaside location of Glenelg in SA in early Sepetember for the 11th Australian Barley Technical Symposium and the 53rd Australian Cereal Chemistry Conference. The joint meeting allowed those of us participating in the Barley Technical Symposium to visit talks held by the Cereal chemists and vice versa. On the first day, joint talks were held addressing new technologies to take the Grains Industry to 2010. Mike Perry, a WA consultant for the GRDC (Grains Research and Development Corporation) generally outlined how the grains industry had progressed in terms of technologies and what that meant to the Grains industry in SA. Subsequent speakers then expanded on this to show how they were using these technologies in their research and what the wider impacts were. The use of technology (such as some really great modeling software) to study the effect of grain morphology, endosperm texture and seperability of bran coats from endosperm in wheat milling was discussed by Frederic Mabille (INRA-Montpellier). The current 'omics' vogue was handled by Professor Geoff Fincher discussing functional genomics and Dr Vladimir Tolstikov (Max-Planck Institute, Germany) discussing metabolomics. Genetic analysis using molecular markers and diversity array technologies was covered by Andrzej Kilian (CAMBIA) and Robbie Waugh (SCRI). In acknowledgement of the impact these genetic technologies have on the marketplace, the Australian Barley Board and the Australian Wheat Board discussed whether markets were ready for GMOs. Both speakers (Maggie Dowling and Tony Russell respectively) presented similar views from their organizations, that is, they believe it is important to have GMOs for research but that the Australian grains industry needs to be certain that the marketplace is ready before commercialization. They both acknowledged that the market is not ready now for GMOs but may be in years to come. A number of papers and posters were presented throughout the conferences with topics as diverse as malting barley quality issues, new molecular marker techniques, breeding, flour properties, barley pathology and abiotic stress. On the last day, the two meetings were joined again to discuss issues in the value chain such as grain receival acceptability determinants, food safety, transport and end use. The end use of barley and wheat was obviously a major focus of the conference with maltsters and brewers having a huge presence and a number of presentations on milling the perfect flour for bread, making the perfect colour grain for noodles and the need to breed biscuit wheats. With all this food discussion, the conference ended with

the appropriate beverages and the obligatory conference dinner.

Congratulations must also go to all those that won awards at the conference. The FB Guthrie Medal (and honorarium) is awarded to a scientist that has contributed significantly to cereal chemistry. This year, the winner was Dr Allen Tarr from the Grain Products Laboratory, Department of Agriculture, WA. The Paul Johnston Memorial Trust Award ($5,000 towards the cost of going to the International Barley Genetics Conference in Czech Republic next year) was won by Elyssia Vassos - a research officer at the University of Adelaide working on trying to improve feed barley varieties to malting quality. The Research Incentive Award (also $5,000 towards the cost of going to the International Barley Genetics Conference in Czech Republic next year) was won by PhD student Tamara Hadaway (supervised by Dr Amanda Able and Dr Helen Collins at the University of Adelaide) for her research looking at the involvement of peroxidases in the formation of black point in barley.

Poster awards ($250) were won by Gai McMichael (a Uni of Adelaide research officer), Louise Robinson (a PhD student supervised by Prof. Andy Barr at the University of Adelaide) and Sergiy Lopato (a postdoctoral fellow in Professor Peter Langridge's lab at the University of Adelaide) for their posters respectively entitled 'Developing marker-trait associations in the population Chieftan/Barque//Manley/VB9104 using novel techniques'; 'The influence of the barley trypsin inhibitor Cme (BTI-Cme) on the potential colloidal stability of beer' and 'Fractionation and Proteomics of the Synctial Endosperm'.

Amanda J. Able
University of Adelaide

UPCOMING CONFERENCES

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The 8th Conference of the International Society for Plant Anaerobiosis (ISPA)

Perth, Western Australia,
Monday 20th to Friday 24th September, 2004.

The conference will be held on the beautiful campus of the University of Western Australia (UWA). For information on UWA, see: www.uwa.edu.au/

Please contact Dr. Tim Colmer (tdcolmer@cyllene.uwa.edu.au) if you would like to receive future announcements regarding this conference.

The 18th International Plant Growth Substance Association Meeting

Canberra Australia

20th-24th September 2004

See http://www.ipgsa.org/meeting.htm