

PHYTOGEN

**A
NEWSLETTER
FOR
AUSTRALIAN
PLANT SCIENTISTS**

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PHYTOGEN

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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



Well, 2001 has just flown by and the New Year is nearly upon us. This final Phytogen for the year includes conference sojourns on topics ranging from cell walls and boron to agriculture in human nutrition and the *Arabidopsis* genome. Of course, there is a report from our own conference, ComBio 2001 as well as some great pictures of members receiving various awards or giving lectures.

This edition also focuses on plant physiology research in the Northern Territory while Jennifer McCutchan has provided the last report of Australia's prime plant physiology journal, as we currently know it (with the name change). Unfortunately, no reports from the discipline representatives or executive were received in the transition phase after the conference. We aim to provide discipline reports in the next issue even if it is only a comment in our Twigs and Branches section.

This year was our first attempt at editing Phytogen and we assure you that it can only get better. Thanks to all the people who have contributed in the past two newsletters. We encourage everybody to contribute, even if it is only a snippet of information!

Hope you all enjoy the festive season and come back feeling refreshed, invigorated and ready to tackle your groundbreaking research.

Until next time....

Amanda and Jason.



Postcard from Vienna

Dr Carolyn Schultz, Department of Plant Science, Adelaide University



September 11, 2001 is a day that will be remembered for the terrorist attacks in the USA. I will also remember being in Vienna. I was just finishing a seminar on arabinogalactan-proteins at the Institute for Molecular Pathology (IMP) when the first plane hit the World Trade Centre in New York. I was in Vienna “between conferences” (see report in this Phytogen) and was visiting an old friend, Dr Marie-Theres Hauser (from my New York University days) and establishing links with the group of Dr Frank Eisenhaber of the Bioinformatics Unit at the IMP. Drs Frank and Birgit Eisenhaber are currently developing algorithms to predict the cleavage site of plant glycosylphosphatidylinositol (GPI)-anchored proteins more accurately.

I am grateful to both Birgit and Marie-Theres for a wonderful time in Vienna. My memories of Vienna are filled with excellent food, strum (fermented pineapple juice) and my first real appreciation of Art. This imaginative use of wheat, and a variety of fruits and vegetables particularly caught my eye. “Summer” was painted by Giuseppe Arcimboldo in 1563 and is one of four paintings by the artist in the permanent collection of Kunsthistorisches Museum in Vienna.



A Conference Sojourn to Deutschland

Dr James Stangoulis, Department of Plant Science, Adelaide University

From mid July through to the beginning of August this year, I was fortunate enough to attend *Boron 2001* (University of Bonn) and the *International Plant Nutrition Colloquium* (IPNC) (University of Hannover). So, what did I think of the conference venues? I was very impressed by the city of Bonn with its cosmopolitan feel, a number of beautiful old buildings and an array of eateries, which I found very hard to keep away from! The symposium venue at the University had an old-world feel and was a very pleasant venue for one week of intense discussion on boron in biology. Bonn is well worth a visit if you are travelling in this region. In contrast to Bonn, Hannover appeared more of a bustling modern city. Extensive bombing throughout World War II has left very few historic buildings. It is noted for its impressive Baroque gardens, for being the home of last year's World Trade Fair, and even for one of the most impressive underground rail systems (we in Adelaide are envious, especially as they have a much smaller population). The IPNC was held at the University of Hannover, an old palace which was an impressive setting, and rightly so for such a significant conference.

For Boron 2001, close to 100 scientists and students attended, with most 'boron labs' represented. In total, 81 extended abstracts were presented and published. Invited boron reviews are currently in press with the journal, *Plant and Soil*.



University of Hannover - Venue for the XIV International Plant Nutrition Colloquium

Reviews covered:

- Specific analytical methods & analytical imaging of boron
- Nutritional importance of boron
- Boron in cell walls
- Boron toxicity in plants and animals
- Boron nutrition of crops and genotypic variation in boron efficiency
- Effects of boron on reproductive development in plants
- Boron fertilizer use on a global scale
- Internal and external boron requirements of plants

The symposium covered the current state of physiological research in a very positive light, with a number of people reporting significant advances in our understanding of this important trace element. Of particular interest were the recent advances in boron uptake. For those of you who have had exposure to boron research, you are probably now shaking your heads and asking yourself just how is it that we are still trying to characterize the kinetics of boron uptake when boron was first found to be essential so long ago (1924 by Katherine Warrington)? Well, our understanding of how boron crosses plasma membranes has been hindered by a lack of boron radioisotope and because of the significant amount of boron in the cell wall, it is hard to accurately measure unidirectional boron influx. With the use of non-radioactive isotopes

^{10}B and ^{11}B , and armed with sophisticated analytical equipment (i.e. ICP-MS) we have only recently been successful in conducting short-term influx experiments. As pointed out by Professor Patrick Brown who gave the plenary lecture on day one of the symposium, in the past few years there is emerging evidence that boron uptake is facilitated at low boron supply, while at higher levels of boron supply, its uptake is a passive process. Advances in this area are made even more significant when one realizes that at the last boron symposium (Chiang Mai, Thailand, 1997), the consensus among scientists was that boron uptake was solely a passive process.

From Bonn I travelled by rail to Hannover to attend the XIV IPNC (where 501 papers were presented). The mixer was held in the Town Hall and the organizers put on a very good spread of food and there was a considerable amount of drink available for those so inclined! For me the highlight of the evening was to catch up with a number of friends and acquaintances whom it seems, I don't get to see until a major conference comes along. Dr Mike Webb from CSIRO Townsville is one such person (my first supervisor at Adelaide University back in the early 90's and pictured).



The focus of the IPNC was 'Food Security and Sustainability of Agro-Ecosystems through Basic and Applied Research'. Bureaucrats from the German Government opened the IPNC and then Dr van Noordwijk (International Centre for Research in Agroforestry, Bogor, Indonesia) gave the plenary lecture entitled 'Plant nutrition: its role in sustainability of simple and complex agro-ecosystems'. Dr van Noordwijk concluded that 'agro-ecosystem sustainability depends on the ability of farmers to maintain soil productivity, avoid angry neighbours, keep customers happy and deal with the regulatory bureaucrats that try to control their activity'. Being a pacifist I'm glad I didn't choose this line of research for my career.

Contributions were allocated to one of twelve areas of plant nutrition research including (with the number of papers contributed to each section in parenthesis):

1. Genetics and molecular biology of plant nutrition (44)
2. Nutrient functions (40)
3. Nutrient uptake and translocation: ion channels and ion pumps (28)
4. The role of the apoplast in plant mineral nutrition (21)
5. Mineral nutrition: plant quality and plant health (42)
6. Salinity and plant-soil-water relations (35)
7. Mineral element toxicity and resistance (42)
8. Nutrient acquisition: mechanisms and modeling (43)
9. Soil organisms/plant interactions (37)
10. Fertilizer use with regard to optimum yield and environment (99)
11. Nutrient dynamics in natural and agricultural ecosystem-processes and modeling (36)
12. Plant nutrition and sustainable development (32)

With such a broad range of subject matter, everyone working in plant nutrition was well catered for and could find an area of interest. So what did I find interesting? Well, there were many papers that I found interesting but since I am moving into the realm of Fe nutrition, and more specifically from a physiological perspective, the identification of the Fe-ligands in rice phloem, I was particularly interested in papers on Fe. For example, Professor Satoshi Mori and his team from Tokyo University presented a paper entitled 'Genetic engineering of transgenic rice with barley strategy-II genes'. Professor Mori and his team were

successful in improving the Fe-efficiency of rice by generating transgenic rice lines with various genes of the phytosiderophore biosynthetic pathway.

While I have very little molecular experience I could see a positive application of this technology in trying to increase the Fe nutrition of rice grain for third world communities where rice is the staple food source. One gets the feeling that there will be an increased focus on human nutrition by many researchers working in the realm of plant physiology and molecular biology. I wonder what would ‘tip’ us more toward this research focus? Well, perhaps Professor Ismail Cakmak’s closing plenary lecture may help to stimulate the move for plant physiologists to move toward solving some of the needs of the poor. His lecture was titled ‘Plant Nutrition Research: Priorities to Meet Human Needs for Food in Sustainable Ways’. He gave the sobering figures that food production on presently used land must be doubled in the next two decades to meet food demand of the growing world population. At least 60% of cultivated soils have growth-limiting problems of mineral-nutrient deficiencies and toxicities, and about 50% of the world’s population suffers from micronutrient deficiencies. To quote Professor Cakmak, the *‘integration of plant nutrition research with plant genetics and molecular biology is indispensable in developing plant genotypes with high genetic ability to adapt to nutrient deficient and toxic soil conditions and to allocate more micronutrients into edible plant products such as cereal grains’*. Clearly, agronomy alone will not solve the many problems facing third world communities. One can see an increasingly important role for plant physiologists and molecular biologists in trying to maintain a supply of nutritious food for the worlds’ population.

Finally, for those who feel that attending a conference is simply a way of getting a free holiday, think again. I have found that by attending meetings such as Boron 2001 and the IPNC, my intellectual battery has been recharged, leading, I’m sure to more productive physiological research, and as a bonus I was able to meet with other scientists to develop new collaborations. Overall, my conference sojourn was very enjoyable and productive. I would also like to thank the GRDC for travel support.





Focusing on one state’s research per edition

This edition:

THE TOP END:

THE NORTHERN TERRITORY



Research at the Northern Territory University, Darwin:
Taxonomy, physiology and nutrition of microalgae and macroalgae.

By Jim Luong Van jim.luong-van@ntu.edu.au

For the past ten years or so, our research group in the School of Biological, Environmental and Chemical Sciences has, among other projects, investigated the ultrastructure, physiology and biochemical characteristics of tropical algae for use in tropical aquaculture, as a food source for larvae of finfish, abalone and bivalve molluscs.



Good growth rates at high temperatures, easy digestibility,

lack of toxicity and high nutritional quality (protein, carbohydrate, lipid, vitamin and fatty acids) are the main criteria for selection of microalgae for tropical aquaculture. Of the 19 species of tropical Australian microalgae investigated, two species (*Rhodomonas* sp. and *Nitzschia paleacea*) are currently being used in several Australian hatcheries, and three species (*Chaetoceros* sp., *Isochrysis* sp., and a prymnesiophyte) have shown to have potential as a live food for aquaculture.

Marine macroalgae from the Darwin region are not as well known as their counterparts from Southern regions. An effort has been made to identify intertidal species, in collaboration with Professor Michael Wynne of Michigan University (UMICH). Many intertidal species have been collected, identified and deposited in UMICH Herbarium. The effect of sedimentation on the growth and recruitment of selected species has been investigated. Currently, the effects of nutrients (nitrogen and phosphorus) and seasons on the proximate chemical contents of dominant species of intertidal species are being studied. Future studies using these algae as experimental systems will include the roles of tropical algae in heavy metal speciations, and in the rearing of tropical edible oysters and clams.

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CSIRO Plant Industry, Darwin

By **Richard Brettell** richard.brettell@pi.csiro.gov.au
& **Sam Blaikie** sam.blaikie@pi.csiro.gov.au

In Darwin, CSIRO has a biological flavour, with three Divisions represented at the Tropical Ecosystems Research Centre on Vanderlin Drive, Berrimah. These are Plant Industry (incorporating Horticulture), Sustainable Ecosystems (formerly Wildlife & Ecology) and Entomology. CSIRO Plant Industry has seen a significant expansion in Darwin over the past three years, from four to eleven staff. Currently there are five scientific staff and four support staff in the Horticulture Unit led by Richard Brettell. In addition, we have Stephen Yeates linked to the CRC for Cotton as coordinator for a program looking at the feasibility of commercial cotton production in Northern Australia. The Horticulture Unit in Darwin currently has a research focus on mango, *Mangifera indica*, a fruit crop that has seen rapid growth in the North over the past ten years. We have established a close working relationship with the NT Department of Business, Industry and Resource Development (NTDBIRD, formerly NTDPIF) and aim to continue strong collaboration within the framework of a consortium that includes the Northern Territory Horticultural Association (NTHA), and also the Northern Territory University (NTU) through which we are also seeking the involvement of higher degree students.

For mango, we are adopting a two-pronged approach to enhance productivity in this warm, tropical environment. The first line of research is to understand the factors responsible for the low productivity of the cultivar Kensington Pride under these conditions, then develop management strategies to improve productivity. One of the principal issues confronting the Australian mango industry is stability of production. Kensington Pride is the most widely grown cultivar and shows vigorous vegetative growth, often at the

expense of flowers, which are normally induced by cooler night temperatures during the dry season (May to September). Erratic flowering and poor fruit set are responsible for significant seasonal fluctuations in yield, hampering the development of coherent marketing strategies for the industry.

Over the past three years Sam Blaikie has conducted an evaluation of two flowering treatments on twelve mango properties in the Darwin and Katherine regions. The first treatment, known as Mango Flowering Treatment (MFT) was developed by CSIRO and involves cutting a cincture around the trunk of the tree and tying a length of twine into the cincture groove. The twine, which has been pre-soaked in a solution of the plant growth regulator, morphactin, acts to deliver the chemical into the tree. The second treatment involves application as a soil drench of paclobutrazol (PBZ), a suppressor of gibberellin biosynthesis in mango. Both treatments were shown to be effective in improving flowering and yield. However, there was variation in the efficacy with a key factor being tree size. Large trees are better suited to MFT, and small trees are better suited to PBZ. Across all sites, absolute yields were low, and at high levels of flowering, the relationship between the level of flowering and yield was poor, suggesting that factors other than flowering are limiting yield in mango. One of the likely candidates is photosynthetic performance. Compared to other varieties, Kensington Pride has low photosynthetic efficiency, particularly under the conditions of high vapour pressure deficits. This means in many orchard situations trees may not have the capacity to produce large quantities of fruit. A major focus of the research being conducted by Alonso Gonzalez and Ping Lu is to develop a carbon budget for mango, using a physiological model that integrates observations at the leaf level to performance of the whole tree.

The second line of our mango research is to participate in the development of new varieties, which can outperform Kensington Pride in the marketplace as well as in production. The National Mango Breeding Program was initiated in 1994 by CSIRO in collaboration with NTDBIRD and State departments in Queensland and Western Australia. Controlled pollinations have produced almost 2000 new hybrids, the first of which produced fruit in the 1999-2000 season. Superior individuals are initially being selected on the basis of fruit characteristics.

We have also started a new project on flowering genes in mango to gain a better understanding of the critical switch from vegetative to floral growth. Anna Padovan has identified mango homologues to *Arabidopsis* genes including *LFY*, *TFL1* and *API*, and current experiments are directed at comparing their patterns of expression in buds induced, and not induced, to flower.



The Horticulture Unit

The Horticulture Unit has in recent years conducted research on other tropical crops including cashew (*Anacardium occidentale*), banana (*Musa* sp.) and mangosteen (*Garcinia mangostana*). This research has been mainly field-based, comprising evaluations of plant physiological performance together with traditional agronomic studies. For example, growing conditions in Northern Australia are favourable for the cashew tree, but irrigation and management guidelines are poorly defined. Our research compared a range of irrigation treatments and demonstrated that a linear relationship existed

between water application and yield. To be internationally competitive, an emerging Australian cashew industry requires productive cultivars producing nuts of high quality, and to this end an improvement program has been conducted in collaboration with QDPI with support from RIRDC. The evaluation phase of the program has been completed and selected hybrids have been planted at secure sites in Darwin and North Queensland, and are available for use by growers.

**Australian Journal of Plant
Physiology
Spring/Summer Update**

Hello, I hope all your plants are behaving themselves!

The value of peer-review....

“The manuscript is intensely boring to read. It appears to have been assembled hastily...”

“This is a poorly written paper. The senior author would do well to buy a copy of the book *How to Write and Publish a Scientific Paper*”

“There is excessive use of unnecessary abbreviations. Delete most of them! In one case the abbreviation is the same length as the direct wording and is therefore of no value.”

“Thank you for the opportunity to review this fascinating investigation. The work was novel, well executed and certainly merits publication.”

“The paper is perhaps the most comprehensive one dedicated to cover this important area of plant research to its entirety. It will be of great use for plant biologists interested in all aspects of phloem biology.”

Peer-reviewed journals rely on the referees to give that crucial ‘value-added’ component. As an Editor, it is my job to regulate this process, through the selection of suitable, unbiased and fair referees (with the help of the Editorial Advisory Committee and International Advisory Panel). While comments, such as some of those above, are not always kind, they can provide a honest and constructive appraisal of a manuscript. If anyone can suggest a legal and hygienic way to post caramel-filled chocolate koalas as a ‘thank you’ to all referees, please let me know!

Ongoing links with ComBio....

It was good to catch up with so many ASPP members at ComBio in Canberra, and a great joy to introduce our new Assistant Editor, Suzanne Farley. The journal has now become a Sustaining Member of the ASBMB to enable us to continue to display our wares at ComBio each year.

The last issue of AjPP....

Suzanne and I are now finalising issue 12 of AjPP Volume 28. The cover of this issue features Oula Ghannoum in her glasshouse, tending to a range of Australian NAD–ME and NADP–ME C₄ grasses. To me, this image represents the best of AjPP, which has always supported the research of young Australian and International scientists, on Australian and other plant species!

A degree of nostalgia passes through the office each day as we change our letterhead, business cards and website to ‘Functional Plant Biology’. Thank you to all who spoke to us at ComBio about the re-launch, expressing your positive thoughts as well as your fond memories of ‘the AjPP days’. Much credit goes to Dr Laurie Martinelli for building AjPP up to such a fine journal over many years. We are looking forward to a relatively seamless transition into FPB. While the overall ‘look’ of the journal won’t change, we look forward to bringing you many improvements in the areas of electronic delivery, colour figure reproduction and pricing, efficient peer-review and timely publication. Thank you for your ongoing involvement and support.

Dr Jennifer McCutchan (Managing Editor, AjPP)



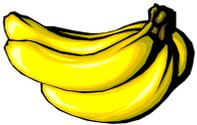
TWIGS & BRANCHES

News & Comments from the
Plant Science World

Novel PCR alternative

A patent has been awarded to US company Boston Biomedica for its novel alternative to PCR known as pressure cycling technology (PCT). PCT controls nucleic acid hybridization via elevated hydrostatic pressure and has the potential to perform PCR under isothermal conditions by pressure cycling (*Chemweb.com*).

Banana Sequences



An international consortium has been formed to sequence the banana genome within five years.

The scientists from 11 countries plan to use the new genetic data to enable the development of banana cultivars resistant to 'Black Sigatoka'. Banana will be the first tropical crop to be sequenced (www.eurekaalert.org).

GM Awareness

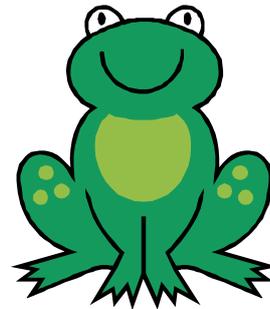
The *Plant Journal* has recently published the first of a series on plant GM technology. This series is freely available at the journal's web site, <http://www.blackwell-science.com/tpj/gm> in an attempt to provide scientific method to the currently emotive debate.

Chloroplast transformation

A new method to transform the chloroplastic genome of tomato has been recently developed (*Nat. Biotechnol* 2001 **19**: 870-875). The desired transgene is introduced into the chloroplast genome through homologous recombination of a chloroplast target sequence. The system appears quite useful in overcoming the current transgenic bane of gene silencing.

Kermit & Plant Disease

Expression of an analog of the antimicrobial peptide, Magainin 2 (isolated from the skin of the African Clawed Frog), in the chloroplast genome of tobacco by Degray et al. resulted in 95% resistance to a suite of pathogens (including *Pseudomonas*, *Aspergillus*, *Fusarium* and *Colletotrichum*) (*Plant Physiol* **127**: 852-862).



Non-coding RNAs

Current genome annotation studies efficiently identify protein-coding genes but rarely detect non-coding RNA (ncRNA) genes due to the lack of significant open reading frames. One group in Michigan has started a systematic sequence analysis of ncRNAs as a first step towards elucidating their functions. They have uncovered about 2 to 3% of the *Arabidopsis* genome as coding for ncRNAs (*Plant Physiol* **127**: 765-776).

Fixation with non-legumes

A recent special issue of *Australian Journal of Plant Physiology* (Volume **28**(9)) addresses the challenge of achieving more biological nitrogen fixation and plant growth promotion through various associative and endophytic systems in the grasses, the use of asymbiotic bacteria and Frankia-based nodulated non-legume plants.

Role of Autumn Colours



Until recently, autumn colours were thought to be associated with senescence. However, they appear to be a handicap signal to insect pests, the first costly

handicap signal to be proposed in plants [For more information see Hamilton and Brown 2001 (*Proc. R. Soc. London B Biol. Sci.* **268**: 1489-1493)]. Alternative evidence suggests that autumnal colours, in particular red, primarily plays a role in photo-protection to allow efficient nutrient retrieval before the leaves fall from the tree (*Plant Physiol* **127**: 566-574).

Science & Education

A survey undertaken by the California Academy of Sciences reveals a profound lack of scientific knowledge by the general public and highlights the need for scientific education to step up a notch (http://www.calacademy.org/geninfo/newsroom/releases/survey_results.htm). More than half of all American adults (53%) do not know that the Earth goes around the Sun once a year. Nearly half (48%) do not have a sense of what percentage of the Earth's surface is covered by water. In addition, 42% could not answer correctly when asked if the earliest humans lived at the same time as dinosaurs. Even college graduates did not fare well, just over a third (35%) were able to respond correctly to all three questions. (<http://www.the-funneled-web.com>)

A Celebration of Diversity

Plant Physiology (Volume 127(4)) has just published a December Special Issue with its front section devoted to the diversity of plant systems, including fragrance, wood formation and bud dormancy.

Anaerobic tolerance

An investigation by Musrar Rahman and colleagues on whether alteration of ethanol fermentation can affect anaerobic tolerance, suggests that alcohol dehydrogenase plays an essential role in seed germination and plant survival in the absence of O₂. The scientists used a transgenic approach manipulating pyruvate decarboxylase (PDC) and alcohol dehydrogenase (ADH) in rice (*Australian Journal of Plant Physiology* **28**: 1231-1241).

New water distribution techniques

Computed tomography (CT), when previously used to monitor water distribution in a single tree over periods of days, months or years, has had a very low spatial resolution. Fromm and colleagues (*Plant Physiology* **127**: 416-425) report on the use of a new, high-resolution CT technique to measure the water content in spruce (*Picea abies*) and oak (*Quercus robur*) stems and branches. The spatial resolution (0.1225 mm³) is so acute that the water content differences within single annual rings can be studied.

Transpiration & Minerals

Transpiration is not essential for long distance mineral distribution throughout a plant according to a study (*Proc Natl Acad Sci USA* **98**: 9443-9447) using sunflowers in which transpiration had been dissociated from a mineral supply.



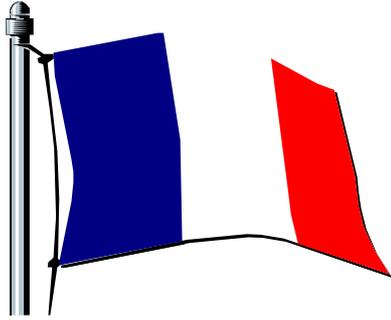
Wheat Breeding

Wheat Breeding into the next century is the topic of the latest *Australian Journal of Agricultural Research* (Volume 52 (11-12)). The special edition focuses on the achievements of the wheat national molecular marker program as well as the future of wheat breeding using a number of biotechnological tools.

Amanda J. & Jason A. Able

9th International Cell Wall Meeting (Toulouse, France, Sept 2-7)

Dr Carolyn Schultz, Department of Plant Science, Adelaide University



Highlights from the talks at the 9th International

Cell Wall Meeting included Debbie Delmar (UC Davis) who provided evidence that cellulose is synthesized on a primer of sitosterol- β -glucoside. This new model for cellulose synthesis requires a cellulase to release mature cellulose and to regenerate the primer. Neil Taylor (University of Manchester) talked about using a HIS-tagged:cellulose synthase (*IRX3*) to show that this CesA interacted with two other CesA proteins. His results suggest the each “bulge” that is seen in a cellulose synthase rosette contains three “different” homodimers (*IRX1*, *IRX3* and *IRX5*). Talks by Dan Cosgrove (Pennsylvania State University) and Stephen Fry (University of Edinburgh) demonstrated novel mechanisms for the extension/modification of non-cellulosic cell wall polymers via a unique fungal protein (*Cell12A*) that belongs to a class of small endo 1,4- β glucanases (Dan Cosgrove) and through a hydroxyl radical and copper-dependent cleaving of polysaccharides (Stephen Fry). Peter Ryden (Institute of Food Research, Norwich) discussed their new method for looking at the strength of primary cell walls. Four-day old dark grown hypocotyls (3 mm lengths) were attached across metal plates and glued in place with cyanoacrylate (superglue). The tensile strength and tensile moduli are measured as the metal plates are moved apart. This method detects differences between wild-type plants and cellulose synthase mutants. Of specific interest to my research is the differential hydroxylation and subsequent glycosylation of proline residues in the proline-rich proteins (PRPs), extensins and arabinogalactan-proteins (AGPs). Jim Cooper (Univ. of California) spoke about the differential hydroxylation of proline-rich cell wall proteins in *Medicago* roots and nodules. Marcia Kieliszewski

(Ohio University) presented new data showing that one of the Lys-rich “classical” AGPs, LeAGP1 from tomato, contained both short arabinosyl chains, commonly found in extensins, and the large arabinosyl- and galactosyl-containing polysaccharides characteristic of AGPs. The relative abundance of these large and small sugar chains was consistent with the relative abundance of non-contiguous and contiguous Pro residues (respectively) in the protein backbone. George Siefert (John Innes Centre) described cloning of the root epidermal bulger gene (*reb1*) mutant. This was often thought to be an “AGP” mutant because it had an altered AGP profile on crossed electrophoresis and it could be phenocopied by Yariv (a specific dye for AGPs). The gene was cloned and found to be a UDP-glucose-4-epimerase like gene. This gene is probably involved in the *de novo* synthesis of D-galactose in roots. This research suggests that the micro-heterogeneity of cell wall glycosylation is controlled by substrate channelling of nucleotide-sugar precursors. A PhD student in Paul Dupree’s lab (University of Cambridge) presented the findings of an algorithm that identifies all of glycosylphosphatidylinositol (GPI)-anchored proteins in Arabidopsis. GPI-anchors are lipid modifications that are added to the C-terminus of many AGPs. In total, they identified 239 proteins (approximately 1% of all proteins) as likely candidates for GPI-anchoring. In addition to 35 AGPs, they identified glucanases (35), proteases (18), lipases (4), phosphodiesterases (6), blue copper binding proteins (25), lipid transfer proteins (19), AGPs (35), receptor-like proteins (20), others (38) and unknown (39).





2nd Annual Arabidopsis & Brassica Functional Genomics Meeting (York, U.K., Sept 27-28)

Dr Carolyn Schultz, Department of Plant Science, Adelaide University

A recurrent theme throughout the 2nd Annual Arabidopsis and Brassica Functional Genomics Meeting was the importance of keeping detailed notes of plant growth conditions, time of harvest, age of tissue, light conditions etc. Many researchers are adopting the Paradigm Genetics plant age classification system (Boyce et al., *Plant Cell* **13**: 1499-1510).

Several researchers discussed metabolomics and its applications. Cathie Martin (John Innes Centre) did metabolic profiling on the *myb4* mutants, belonging to the Myb class of transcription factors. They observed different levels of sinapoyl malate, which is at the end of one of the phenylpropanoid pathways. Nick Smirnoff (University of Exeter) used metabolic profiling to look at the *vtc1* mutant (vitamin c-1) that was recently shown to have a defect in GDP-mannose pyrophosphorylase. The only difference they have observed at this stage with metabolic profiling is that the mutant has increased levels of L-galactose in the cell wall.

Not surprisingly, there was a lot of talk about microarrays. GARNet (Genomic Arabidopsis Resource Network) is working towards a Complete Arabidopsis transcript microarray (CATMA). Jim Beynon (Horticulture Research International, Wellesbourne) discussed how they are developing software (specific primer and amplicon design software, SPADs) to design gene specific tags (GSTs) to go on new chips. As part of this research, they have re-annotated the Arabidopsis genome and come up with 71,420 genes! They were not particularly confident about this re-annotation, but it does highlight that it will be a long time before we are sure of the number of Arabidopsis genes. Primer pairs for the first 16,280 GSTs will be available on their web site

next year. They are also planning to use the gene specific tags to make RNAi constructs.

Several groups presented the results of their microarray experiments using the Affymetix chips. Stacey Harmer, a post-doc in Steve Kay's lab (The Scripps Research Institute) showed that they have found four groups of genes that peaked at different times of day/night. A motif called the evening element (AAAATATCT) was invariant in evening phase genes. They multimerized this element and put it in front of a minimal promoter to get cycling of the reporter gene.

Kenneth Birnbaum from Philip Benfey's lab at New York University described experiments that used a fluorescence activated cell sorter (FACS) to select cells of a specific subtype from root (e.g. endodermis). Protoplasts from marker lines expressing GFP in specific cell types were made rapidly (30 mins, at 37°C) and then GFP expressing cells were separated from non-expressing cells. Their initial microarray results look promising.

The *Physcomitrella* EST program was discussed in some detail at the meeting. 14,000 ESTs (<http://www.moss.leeds.ac.uk>) have been sequenced thus far (Celia Knight, University of Leeds). This moss is interesting because they can do efficient gene targeting and therefore it offers the potential for studying allele replacement *in vivo*!

One of the challenges of researching with Arabidopsis is its small size and perceived difficulty of doing certain classical plant physiology experiments. Colin Turnbull (formerly of UQ, now University of London) described his robust micro-grafting experiments to test for long-distance signalling in Arabidopsis.

ComBio 2001

Conference Report

Iain Searle, The University of Queensland

ComBio 2001 was held this year in our Nation's capital, Canberra. The conference provided a stimulating environment and opportunity to learn about a broad range of topics. Within these topics, a strong emphasis on plant biology and proteomics was maintained over the four days of the conference. Some of the scientific addresses will be briefly outlined, and my apologies to those presenters who are unfortunately not mentioned.

A number of excellent plenary speakers provided us with "food for thought". Professor Jeff Dangl provided a stimulating insight into the current understanding of plant-pathogen interactions, which resulted in many enthusiastic scientists hovering around Jeff and asking questions after his presentations. Professor Chris Leaver also provided a stimulating address about the molecular basis of cytoplasmic male sterility in sunflower. Dr George Coupland provided an excellent address on our current understanding of the control of flowering in *Arabidopsis* and the interactions between genes and environmental signals. Between each of these plenary speakers, concurrent symposia provided an opportunity for established and young and up-coming researchers to present their results.

The nutrient acquisition and deficiencies symposium provided Dr Steven Mudge, CSIRO Plant Industry - Brisbane, a platform to present his results on the cell specificity and phosphate responsiveness of nine *Pht* phosphate transporters from *Arabidopsis*. Promoter fusions of each transporter with GFP provided a visually entertaining insight into the cellular expression of each transporter. Dr Suzanne Schmidt, Botany Department UQ, provided a hint at the role club roots play in the acquisition of nitrogen and phosphorous from the soil. Dr Artem Men, a member of the genetics and genomics group in the Botany Department UQ, presented results on identifying leguminous genes required for nitrogen fixation. Artem highlighted the promoter-trapping research being performed in *Lotus japonicus* by Dr Jirri Stiller, and showed slides of several promoter-trapped *Lotus* lines. Artem also presented results of the progress towards the map-based cloning of the supernodulation gene from soybean.

The gene silencing and epigenetics symposium provided an opportunity for five scientists to present results on the hot topic of RNA interference (RNAi). Dr Wang, CSIRO Plant Industry - Canberra, presented a seminar about RNA-directed RNA degradation and DNA methylation and its role in eukaryotic biology. Dr Rachel Burton, Adelaide University, presented results on the practical application of RNAi to knockout the cellulose synthase family to further understand the role of these genes in cell wall development. On the flip side of RNAi, Julie Waldron, Department of Biochemistry and Parasitology UQ, presented results on the identification of DNA sequences for alleviating transgene silencing (RNAi) in sugarcane. Her data was relevant to all genetic engineering groups.

The diverse nature of the ComBio conferences always provides an opportunity to broaden our knowledge. This was easily achieved with over 400 posters on topics of proteomics, protein structure and function studies, plant development and many other topics. The conference dinner held at the National Art Gallery also provided a social platform to broaden our knowledge of science, but mainly food, wine and funky dancing. The dinner was enjoyed by all, and even to the extent of some rebels partying until the sun rose on the final day of the conference. Overall, the conference was enjoyed by the masses and commendations to the organizers of ComBio 2001.

P.S. Congratulations to Dr Christine Beveridge, UQ, for being awarded the Peter Goldacre Award. Christine was awarded the prestigious accolade for her pioneering research on signalling and branching of pea.

OTHER COMBIO TIDBITS

STUDENT POSTER PRIZES



Congratulations to Tursun Kerim (Genomic Interaction Group, RSBS, ANU), Andrea Robold (Plant Cell Biology Group, RSBS, ANU), Francine Perrine (Genomic Interaction Group, RSBS, ANU) and Carla Wolbang (School of Plant Science, University of Tasmania) on being the student poster prize winners for ComBio 2001. They each won \$100 and a certificate for their efforts.

TEACHING AWARD

Congratulations to Janet Gorst (QDPI) for winning the Teaching Award sponsored by John Morris Scientific. Janet was presented with \$1000 by Andre Wyzenbeek on behalf of John Morris Scientific. The Society would like to thank John Morris Scientific for their support of this very worthwhile prize.



GOLDACRE AWARD



This year's winner of the Goldacre award was Christine Beveridge (from UQ) for her groundbreaking research on signalling and branching (see the last *Phytogen* issue for more details of Christine's research). President Hans Lambers awarded Christine a medal and a cheque for \$2000.

Last year's winner Barry Pogson gave the Goldacre lecture this year. His research group is seeking to understand the mechanisms and regulation of plant responses to abiotic stress. A central aspect of this research is to define the biosynthesis and function of the carotenoids, such as beta-carotene. A range of molecular genetic and biochemical approaches have provided insight into carotenoid function during seedling development and into their roles as antioxidants in chloroplasts. We also look forward to Christine's lecture next year!

J.G. WOOD & ANNALS OF BOTANY LECTURES

This year, the **J.G. Wood Lecture** was given by John Passioura. John (CSIRO, PI, Canberra) spoke about Environmental Biology in Agriculture. His research has centred on the environmental biology of dryland crops, especially those whose yield is limited by water or salinity. He and colleagues have shown that the rate of development of leaf area is an important determinant of crop yield and that this development is strongly affected by inhibitory signals from roots growing in inhospitable soil – soil that is too dry, too salty or too hard. He has also been involved in theoretical analysis and modeling of the molecular choreography of the wall of expanding cells, and of the importance of the flow of water through growing plant tissues in influencing growth rate. Currently he is working on the mechanisms by which soil temperature profoundly influences shoot growth. With GRDC, John has been overseeing projects on soil and water management that collectively aim at improving both the productivity and environmental performance of grain farms.



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The **Annals of Botany** lecture was given by Mark Tester (Department of Plant Sciences, University of Cambridge) who in the early 1990's characterised single Ca^{2+} -selective channels from wheat roots. The aim of his current research at Cambridge is to elucidate the molecular basis for plant adaptations to particular soil conditions, such as saline or acidic soils, and ultimately to genetically engineer crop plants with increased productivity. He uses electrophysiological tools, supported by radioactive tracer fluxes and whole plant growth measurements, and has recently adopted molecular techniques for both gene characterisation and cell-specific gene mis-expression. Current research focuses on characterisation of the role of nonselective channels in Na^+ influx and the function of glutamate receptor orthologues in higher plants; identification of genes encoding Ca^{2+} entry across the plasma membrane; the control by ABA of solute loading into the xylem; and the mechanism and control of boric acid transport.



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LIFE MEMBERSHIP FOR PAUL KRIEDEMANN

For his never ending devotion to the society and wonderful job as Hon. Secretary, Paul Kriedemann was awarded a lifetime membership of the society (presented by Treasurer John Evans) and a thank you gift of a Celia Rosser drawing of *Banksia serrata* (presented by Rana Munns). Congratulations Paul and again the wonderful job has been much appreciated by all members of the society.



Amanda J. Able
Photos by Rana Munns



WEBSITES

Are you interested in research happening in the UK and Ireland, then visit www.FindaPhD.com. Although primarily aimed at students looking to enroll in their PhD, there is also a lot of information about various life sciences and chemistry departments and their research. The Science Registry Ltd is responsible for the FindA PhD site as well as www.FindAPost-Doc.com.

Web sites for finding out if there is an *Arabidopsis* insertion line in your favourite gene include:

- The Versailles collection of T-DNA insertion mutants (~50,000 independent transformants).
<http://flagdb-genoplante.info.infobiogen.fr/projects/fst/>
- Syngenta's T-DNA lines available for collaborations (with border sequences of 100,000 T-DNA lines (ecotype Columbia)).
<http://www.tmri.org>
- the Genomic *Arabidopsis* Resource Network (<http://www.york.ac.uk/res/garnet/garnet.htm>). All GARNet services and resources are publicly available, and data created using the GARNet resources will be freely distributed.

Minimal information standards for a microarray experiment are detailed at <http://www.cbil.upenn.edu/Ontology/>.

Visit <http://afgc.stanford.edu/> for the details and information on metabolomics. A wheat metabolomics service is soon to be established to compare GM and non-GM wheat in conjunction with the food standards agency in the UK (<http://www.foodstandards.gov.uk/>).

Do you work on plant cell walls? Then this new information / resource-sharing network, WallBioNet may be for you: <http://xyloglucan.prl.msu.edu>.

Waite Analytical Services

Waite Analytical Services (WAS) is based at the Adelaide University and specializes in the elemental analysis of plant tissue. WAS offers Australasian Soil and Plant Analysis Council (ASPAC) accredited analysis to both commercial clients (i.e. farm consultants where they require crop nutrient analysis), and research clients with more highly specialized scientific applications where very low detection limits coupled with a high level of accuracy is required. Although an average of 37,000 samples is analysed annually, the laboratory is not running at full capacity and we would invite more research scientists to use the facilities.

An ARL 3580 Inductively Coupled Plasma Optical Emission Spectrometer (ICPOES) has been the laboratory's workhorse for 15 years and we are in the process of commissioning the replacement instrument, a Spectro CIROS ICPOES. This will give even lower detection limits than the old ARL. We perform plant elemental analysis for aluminium, boron, cadmium, calcium, cobalt, copper, iron, manganese, magnesium, molybdenum, nickel, phosphorus, potassium, selenium, sodium, sulfur and zinc. We also analyse total nitrogen by Total Combustion Gas Chromatography using a Carlo Erba NA 1500. CSIRO Land and Water Division, the University of South Australia and the University of Adelaide have collaboratively purchased an AGILENT ICPMS that is currently being commissioned. In the future this will be available both for elemental analysis at ultra low levels and speciation of elemental complexes.

Prices vary according to client requirements, and we recommend WAS be contacted for further details. The laboratory manager (Teresa Fowles) is happy to discuss your requirements for ICPOES and Total Nitrogen, and to provide you with a written quote. We are also keen to get expressions of interest for ICPMS and ICPMS-HPLC applications, so that we can plan ahead.

Email: teresa.fowles@adelaide.edu.au

Telephone: +61 8 8303 7391

UPCOMING CONFERENCES

UPCOMING CONFERENCES

INTERNATIONAL ASSOCIATION FOR PLANT TISSUE CULTURE & BIOTECHNOLOGY



AUSTRALIAN BRANCH 7TH MEETING

Plant Tissue Culture - Its importance in Biology,
Ecology and Agriculture & Horticulture

20-23 January 2002
University of New England
Armidale NSW Australia

Abstract Submission Deadline: 10 September 2001
Early Bird Registration: 15 October 2001
Registration Deadline: 10 December 2001

Further Information: ataji@metz.une.edu.au

ICPM 2002

THE 6TH INTERNATIONAL CONGRESS
ON PLANT MITOCHONDRIA
JULY 10 – 14, 2002
THE ESPLANADE HOTEL,
FREMANTLE, WA

For more details, contact:

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Email : ICPM@uwa.edu.au*

www.icpm.uwa.edu.au



FIRST ANNOUNCEMENT

The inaugural International Rice Congress will take place in 2002 to address issues related to rice research, production, processing, trade and consumption, as well as the sustainable improvement of the livelihood of rice farmers and consumers.

Where: Beijing, China.
When: 16th – 20th September 2002.

<http://www.irri.org/IRC2002/introduction.htm>

13th Australian Weeds Conference

WEEDS: threats now, and forever?

**Sheraton Perth Hotel
Western Australia
9th - 13th September 2002**

On behalf of the Plant Protection Society of Western Australia and the Council of Australian Weed Science Societies (CAWSS) we invite you to attend the 13th Australian Weeds Conference. This will be Australia's first weed conference in the 21st Century.

<http://home.vicnet.net.au/~weedss/>

UPCOMING CONFERENCES cont..

12TH AUSTRALASIAN PLANT BREEDING CONFERENCE

15th – 20th September 2002
Perth
Australia

Conference Theme:
Plant Breeding for the 11th Millennium

The 12th APBC will also herald the beginning of the Australasian Plant Breeding Society Inc., established to meet the professional needs of plant breeders in agriculture, forestry and horticulture in Australia and New Zealand.

For further information:
<http://www.congresswest.com.au/PB/>

1ST INTERNATIONAL CONGRESS ON METABOLOMICS

7th to 11th April 2002
Wagenin, Netherlands
Contact: Emmy van Balen
– E.vanBalen@plant.wag-ur.nl

Plant Biology 2002



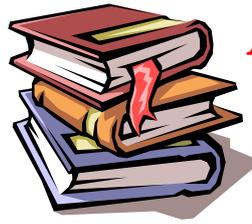
3rd – 7th August 2002
Denver, Colorado, USA

Selected Featured Symposia:

President's Symposium - "Dynamic Processes"
Gibb's Medal Symposium - "High Throughput Plant
Biology in the Post-Genomics Era"

Abstract Call (Posters/Mini-Symposia): November 2001
Abstract Submission Deadline: 1st March 2002

Further information:
<http://www.aspb.org/meetings/pb-2002/prelim.cfm>



LIGHT READING!

Biology and Biotechnology of the Plant Hormone Ethylene II

Editors:

- **A.K. Kanellis** (*Aristotle University of Thessaloniki, Greece*)
- **C. Chang** (*University of Maryland, College Park, USA*)
- **H. Klee** (*University of Florida, Gainesville, USA*)
- **A.B. Bleecker** (*University of Wisconsin-Madison, USA*)
- **J.C. Pech** (*ENSAT, UA INRA, Toulouse, France*)
- **D. Grierson** (*University of Nottingham, Sutton Bonington Campus, UK*)

The rapid advances in elucidating the mechanisms of ethylene perception and synthesis by plants, the signal transduction pathway, and ethylene control in transgenic plants have made the organization of a series of conferences dedicated to the plant hormone ethylene imperative. It is noted here that studies on ethylene have led the way in enhancing our understanding of the biosynthesis of a plant hormone at the biochemical and molecular levels, and future studies should further help in the understanding of the biochemical machinery responsible for the perception and signal transduction of this plant hormone.

The purpose of this Symposium was the critical assessment of the existing knowledge and the exchange of new ideas on the mechanisms of ethylene synthesis, perception and signal transduction, its role in pathogenesis and stress, its involvement in plant growth and development and, lastly, the biotechnological control of its formation and function.

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