

Showcase on Research

EDITORIAL

Molecular Responses of Plants to Environmental Stress

Because plants cannot escape their environment, they have learnt to cope with a wide range of environmental stress conditions, including attack from pests, metal toxicity, nutrient deprivation, temperature extremes, and both too little and too much water. The response of plants to these situations determines their survival and performance in hostile environments and is a topic of intense research at the moment, both within Australia and overseas. An emerging theme from this research is that both biotic and abiotic stresses often lead to production of reactive oxygen species within the cell and trigger common pathways of signal transduction leading to expression of genes which help the plant to cope with oxidative stress. These pathways appear to very similar to the better defined pathways in mammalian cells. The eventual aim of this research is to identify novel protection mechanisms which can be manipulated genetically to enhance plant growth and performance.

In the first article in this issue, Harvey Millar and Jim Whelan from the University of Western Australia write generally about the oxidative stress responses of plants and the role of mitochondria in these responses. Three articles on more specific themes then follow. Carol Andersson and colleagues from the CSIRO Division of Plant Industry in Wembley, Perth, describe their work on transcription factors involved in the defence response of plants to pathogen attack. Rudy Dolferus et al. from the same CSIRO Division in Canberra write about the molecular events that occur when plants experience the oxygen deprivation which accompanies flooding and water logging of soils. Finally, Christopher Cobbett from the University of Melbourne discusses the role of phytochelatin in heavy metal detoxification in plants.

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Cover Illustration –

Luminescence images of *Arabidopsis thaliana* seedlings carrying the firefly luciferase reporter gene under the transcriptional control of an *Arabidopsis* glutathione S-transferase (GST6) gene promoter. Seedlings were incubated for 16 hours either with (+SA) or without (-SA) the plant signalling molecule, salicylic acid (SA), then sprayed with the enzyme substrate, luciferin. Seedlings were imaged with a cooled CCD camera. The higher levels of light emitted by the SA-treated seedlings reflects the transcriptional activation of the GST6 promoter in response to this plant stress signal (see article by Andersson et al. in this issue). [Background images of *Arabidopsis* plants kindly provided by David Smyth, Department of Biological Sciences, Monash University]

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Guest Editor: David Day

- Stress, Oxidative Damage and Plant Mitochondria
A. Harvey Millar and James Whelan
- Transcriptional Control of Plant Defence Gene Expression
Carol R. Andersson, Rhonda C. Foley, Luis Oñate-Sánchez and Karam B. Singh
- Molecular Basis of the Anaerobic Response in Plants
R. Dolferus, E.J. Klok, K.P. Ismond, C. Delessert, S. Wilson, W.J. Peacock and E.S. Dennis
- Heavy Metal Detoxification in Plants: Phytochelatin Biosynthesis and Function
Christopher S. Cobbett

In the Next Issue...

In April, Showcase on Research will be on **Signal Transduction** – Guest Editor: Marie Bogoyevitch

