

# Functional Plant Biology

## Contents

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<p><i>Viewpoint:</i> Plant nutrient acquisition and utilisation in a high carbon dioxide world</p>	87–96	<p>In this viewpoint article, we explore the impacts of elevated CO<sub>2</sub> on arbuscular mycorrhizas and plant secondary metabolites involved in defence against herbivores. In doing so, we seek to encourage a more integrated approach to investigation of all aspects of plant responses to elevated CO<sub>2</sub>.</p>
<p>Stressed crops emit more methane despite the mitigating effects of elevated carbon dioxide</p>	97–105	<p>Higher temperature and water stress enhance plant methane emission. Elevated CO<sub>2</sub> only partially reverses those effects. Despite the mitigating effects of increased CO<sub>2</sub>, plant methane emission may be higher in the face of ongoing global climate change. Since methane is a potent greenhouse gas this could influence future global temperature.</p>
<p>Linking canopy temperature and trunk diameter fluctuations with other physiological water status tools for water stress management in citrus orchards</p>	106–117	<p>Canopy temperature and trunk-diameter fluctuations are highly effective for characterising plant water status. Significant relationships can be established between stem water potential or stomatal conductance and maximum daily shrinkage and canopy air temperature differential. Combining these techniques would aid irrigation decisions in citrus orchards with highly variable plant water stress.</p>
<p>Two measures of leaf capacitance: insights into the water transport pathway and hydraulic conductance in leaves</p>	118–126	<p>This investigation showed that two different measures of leaf capacitance associated with short- and medium-term fluctuations in transpiration are related to differences in leaf structure and anatomy and influence the determination of hydraulic conductance. Our results suggest that leaf tissue in some species is hydraulically compartmentalised and that only a portion of the leaf actively exchanges water with the transpiration stream.</p>
<p>Modelling phloem transport within a pruned dwarf bean: a 2-source-3-sink system</p>	127–138	<p>Münch hypothesis of phloem transport has been difficult to quantitatively apply to a realistic plant architecture. Additional known mechanistic detail compounds this difficulty. Advances in numerical methods have enabled improved simulations, which now extended into multiple-source multiple-sink systems. Validation of the approach is made by comparison with tracer experiments on bean plants.</p>

*Cover illustration:* Anatomical detail of *Hakea lissosperma* leaves in cross-section (see Blackman *et al.* pp. 118–126; Photograph by Chris Blackman).

Salt-induced accumulation of glycine betaine is inhibited by high light in durum wheat  
**Petronia Carillo, Danila Parisi, Pasqualina Woodrow, Giovanni Pontecorvo, Giuseppina Massaro, Maria Grazia Annunziata, Amodio Fuggi and Ronan Sulpice** 139–150

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In durum wheat, high light treatment inhibits the synthesis of glycine betaine, even in the presence of salt stress. Its absence is balanced by a reshaping of the cellular content of metabolites such as amino acids and hexoses. In particular, tyrosine could contribute to protect cells against salt-induced oxidative stress.

Overexpression of the MYB-related transcription factor GCC7 in *Arabidopsis thaliana* leads to increased levels of P<sub>i</sub> and changed P-dependent gene regulation  
**Maria Lundmark, Lena Nilsson, Camilla J. Korner and Tom H. Nielsen** 151–162

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A transcription factor termed GCC7 was studied in Arabidopsis. GCC7 is a homolog of PHR1, which is important for gene regulation during phosphate starvation. It is here shown that overexpression of GCC7 result in accumulation more phosphate in shoots and strongly interferes with phosphate dependent gene regulation. Yet, a *gcc7* knock out mutant still responds phosphate starvation.

Characterisation of *HvALMT1* function in transgenic barley plants  
**Benjamin D. Gruber, Emmanuel Delhaize, Alan E. Richardson, Ute Roessner, Richard A. James, Susan M. Howitt and Peter R. Ryan** 163–175

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*HvALMT1* encodes an anion channel in barley which is expressed in guard cells and some root tissues. We investigated *HvALMT1* function by overexpressing it in barley and Arabidopsis. We conclude that *HvALMT1* contributes to osmotic adjustment and ion homeostasis by transporting malate out of cells or into sub-cellular vesicles.