

Functional Plant Biology

Contents

Volume 35 Issue 7 2008

Editorial: New series: the evolution of plant function

Rana Munns

Review: Alternative oxidase: an inter-kingdom perspective on the function and regulation of this broadly distributed 'cyanide-resistant' terminal oxidase

Allison E. McDonald 535–552

Alternative oxidase (AOX) is a terminal quinol oxidase found in the respiratory electron transport chains of a large number of diverse organisms, but its physiological function remains elusive. A comparative approach is used to examine the biochemical function of AOX and its transcriptional and post-translational regulation. Hypotheses about the physiological function(s) of AOX are explored and future research opportunities in this exciting field are presented.

Deactivation of aquaporins decreases internal conductance to CO₂ diffusion in tobacco leaves grown under long-term drought

Shin-Ichi Miyazawa, Satomi Yoshimura, Yuki Shinzaki, Masayoshi Maeshima and Chikahiro Miyake 553–564

Low diffusion conductance to CO₂ from the leaf intercellular air space to the chloroplasts (internal conductance) limits the net photosynthesis rates in plants growing under long-term drought. This paper shows that the low internal conductance is due to deactivation of the leaf aquaporins in response to drought stress.

Hydraulic and chemical signalling in the regulation of stomatal conductance and plant water use of field grapevines growing under deficit irrigation

M. Lucília Rodrigues, Tiago P. Santos, Ana P. Rodrigues, Claudia R. De Souza, Carlos M. Lopes, João P. Maroco, João S. Pereira and M. Manuela Chaves 565–579

Research on the factors acting in stomata regulation of water stressed grapevines is presented in this study. Both hydraulic feedback and feed-forward root-to-shoot chemical signalling mechanisms might be involved in the control of the stomata aperture in response to decreased soil water availability, although hydraulic signals appear to play the dominant role.

Adjustment of osmotic pressure coupled with change of growth mode in *Spirogyra*

Katsuhisa Yoshida, Ai Ohtani, Tetsuro Mimura and Teruo Shimmen 580–584

In a *Spirogyra* sp., a terminal cell of algal filament forms rhizoid. In this paper, we found that osmotic pressure of a terminal cell was adjusted during rhizoid differentiation. This change observed before the start of rhizoid tip growth. Possible roles of the adjustment of osmotic pressure in rhizoid differentiation are discussed.

Cover illustration: A mitochondrial electron transport chain showing the position of alternative oxidase (AOX). Complex IV is inhibited by cyanide, nitric oxide (NO), sulfide and azide, while AOX is insensitive to these compounds and is instead inhibited by salicylhydroxamic acid (SHAM) and n-propyl gallate (nPG). Complex I, NADH dehydrogenase; Complex II, succinate dehydrogenase; Complex III, cytochrome bc₁ complex; Complex IV, cytochrome c oxidase; cyt c, cytochrome c; e⁻, electrons; IMM, inner mitochondrial membrane; UQ, ubiquinol pool (see McDonald pp. 535–552).

Transcriptome analysis of leaf tissue from Bermudagrass (*Cynodon dactylon*) using a normalised cDNA library
Changsoo Kim, Cheol Seong Jang, Terry L. Kamps, Jon S. Robertson, Frank A. Feltus and Andrew H. Paterson

585–594

Genomic information for the chloridoid cereals is limited. The chloridoid Bermudagrass (*Cynodon dactylon* L.) is widely cultivated as a turfgrass and forage/biomass crop. A normalised cDNA library from Bermudagrass leaf tissue was constructed, 15,588 ESTs sequenced, and 9,414 unigenes assembled and annotated by various comparative genomic tools and approaches.

Photoprotection of PSII in Hawaiian lobeliads from diverse light environments
Rebecca A. Montgomery, Guillermo Goldstein and Thomas J. Givnish

595–605

We demonstrated a strong quantitative relationship between photoprotective energy dissipation via the xanthophyll cycle and growth light environments across a large group of closely related species, providing evidence for adaptive diversification in photosynthetic physiology in the Hawaiian lobeliads.

Arabidopsis thaliana MYB75/PAP1 transcription factor induces anthocyanin production in transgenic tomato plants
Diana Lucia Zuluaga, Silvia Gonzali, Elena Loreti, Chiara Pucciariello, Elena Degl'Innocenti, Lucia Guidi, Amedeo Alpi and Pierdomenico Perata

606–618

Tomato plants were transformed with the *Arabidopsis* MYB75/PAP1 gene, encoding a transcription factor involved in anthocyanin production. As a consequence of *AtMYB75* expression, transgenic plants showed an up-regulation of *DFR* transcription and a higher production of anthocyanins in vegetative organs, in flowers and fruits. They also presented reduced photobleaching damages under high irradiance.

Effects of a barley (*Hordeum vulgare*) chromosome six grain protein content locus on whole-plant nitrogen reallocation under two different fertilisation regimes
Nancy M. Heidlebaugh, Brian R. Trethewey, Aravind K. Jukanti, David L. Parrott, John M. Martin and Andreas M. Fischer

619–632

Analysis of near-isogenic germplasm differing in the allelic state of the locus named in the title indicates that it exerts control over grain protein content (GPC) by influencing plant storage and allocation of both organic and inorganic nitrogen. Specifically, presence of high-GPC allele(s) at this locus leads to earlier flag leaf senescence and organic N retranslocation to developing kernels, while also enhancing post-anthesis flag leaf nitrate contents.

Silicon-mediated improvement in the salt resistance of wheat (*Triticum aestivum*) results from increased sodium exclusion and resistance to oxidative stress
Muhammad Saqib, Christian Zörb and Sven Schubert

633–639

Silicon increases cell-wall Na⁺ binding and decreases potentially toxic leaf sap Na⁺ concentration. Silicon decreases plant Na⁺ uptake and shoot-to-root Na⁺ distribution, and increases shoot K⁺: Na⁺ ratio and glutathione concentration. Therefore, silicon-mediated improvement in the salt resistance of wheat results from increased sodium exclusion and resistance to oxidative stress.

Multiple traits associated with salt tolerance in lucerne: revealing the underlying cellular mechanisms
Christiane F. Smethurst, Kieren Rix, Trevor Garnett, Geoff Auricht, Antoine Bayart, Peter Lane, Stephen J. Wilson and Sergey Shabala

640–650

This study investigates mechanisms conferring salt tolerance in lucerne (*Medicago sativa* L.) and suggests that different genotypes employ two very different strategies, namely excluding Na⁺ from uptake or sequestering Na⁺ in leaf mesophyll. In both cases, better K⁺ retention ability was found. Prospects for germplasm screening for salt tolerance are discussed.