**ON THE INSIDE**

*Peter V. Minorsky*

**FOCUS ISSUE ON THE BIOLOGY OF TRANSPERSION**

**EDITORIAL**

The Biology of Transpiration. From Guard Cells to Globe. *Susanne von Caemmerer and Neil Baker*

**UPDATES**

  
- Heavy Water Fractionation during Transpiration. *Graham D. Farquhar, Lucas A. Cernusak, and Belinda Barnes*  
  
- The Control of Transpiration. Insights from Arabidopsis. *Sarah E. Nilson and Sarah M. Assmann*

**RESEARCH ARTICLES**

- Ca²⁺-Dependent and -Independent Abscisic Acid Activation of Plasma Membrane Anion Channels in Guard Cells of *Nicotiana tabacum*. *Holger Marten, Kai R. Konrad, Petra Dietrich, M. Rob G. Roelfsema, and Rainer Hedrich*  
  
- Programmed Cell Death-Involved Aluminum Toxicity in Yeast Alleviated by Antiapoptotic Members with Decreased Calcium Signals. *Ke Zheng, Jian-Wei Pan, Lan Ye, Yu Fu, Hua-Zheng Peng, Bai-Yu Wan, Qing Gu, Hong-Wu Bian, Ning Han, Jun-Hui Wang, Bo Kang, Jun-Hang Pan, Hong-Hong Shao, Wen-Zhe Wang, and Mu-Yuan Zhu*  
  
- Characterization of a Novel Plant Promoter Specifically Induced by Heavy Metal and Identification of the Promoter Regions Conferring Heavy Metal Responsiveness. *Xiaoting Qi, Yixiu Zhang, and Tuanyao Chai*
Embolism Formation during Freezing in the Wood of Picea abies. Stefan Mayr, Hervé Cochard, Thierry Améglio, and Silvia B. Kikuta

Modification of Leaf Apoplastic pH in Relation to Stomatal Sensitivity to Root-Sourced Abscisic Acid Signals. Wensuo Jia and William John Davies

The Mechanical Diversity of Stomata and Its Significance in Gas-Exchange Control. Peter J. Franks and Graham D. Farquhar

Spatial Variation of Deuterium Enrichment in Bulk Water of Snowgum Leaves. Jiří Šantrůček, Jiří Kvočoň, Jiří Šetlík, and Lenka Bulíčková

Environment or Development? Lifetime Net CO₂ Exchange and Control of the Expression of Crassulacean Acid Metabolism in Mesembryanthemum crystallinum. Klaus Winter and Joseph A.M. Holtum

Evaluation of Source Leaf Responses to Water-Deficit Stresses in Cotton Using a Novel Stress Bioassay. John J. Burke

Putative Role of Aquaporins in Variable Hydraulic Conductance of Leaves in Response to Light. Hervé Cochard, Jean-Stéphane Venisse, Tété Séverien Barigah, Nicole Brunel, Stéphane Herbette, Agnès Guillaud, Melvin T. Tyree, and Souliamani Sakr


Helianthus Nighttime Conductance and Transpiration Respond to Soil Water But Not Nutrient Availability. Ava R. Howard and Lisa A. Donovan

REGULAR ISSUE

GENOME ANALYSIS

Genome-Wide Analysis of the Arabidopsis Leaf Transcriptome Reveals Interaction of Phosphate and Sugar Metabolism. Renate Müller, Marc Morant, Hanne Jørger, Lena Nilsson, and Tom Hamborg Nielsen

Combining Expression and Comparative Evolutionary Analysis. The COBRA Gene Family. Siobhan M. Brady, Shuang Song, Kanwarpal S. Dhugga, J. Antoni Rafalski, and Philip N. Benfey

BIOCHEMICAL PROCESSES AND MACROMOLECULAR STRUCTURES

Arabidopsis Sucrose Transporter AtSUC9. High-Affinity Transport Activity, Intragenic Control of Expression, and Early Flowering Mutant Phenotype. Alicia B. Switz, Anke Reinders, Meghan E. Johnson, Anthony D. Krentz, Christopher P. L. Graf, Jai M. Perroux, and John M. Ward

Insights into the Role of Specific Lipids in the Formation and Delivery of Lipid Microdomains to the Plasma Membrane of Plant Cells. Maryse Laloi, Anne-Marie Perret, Laurent Chatre, Su Melser, Catherine Cantrel, Marie-Noëlle Vautier, Alain Zachowski, Katell Bathany, Jean-Marie Schmitter, Myriam Vallet, René Lessire, Marie-Andrée Hartmann, and Patrick Moreau

CELL BIOLOGY AND SIGNAL TRANSDUCTION

Characterization of the Preprotein and Amino Acid Transporter Gene Family in Arabidopsis. Monika W. Murcha, Dina Elhafez, Ryan Lister, Julian Tonti-Filippini, Manuela Baumgartner, Katrin Philippar, Chris Carrie, Dejana Mokranjac, Jürgen Soll, and James Whelan

GIGANTEA Acts in Blue Light Signaling and Has Biochemically Separable Roles in Circadian Clock and Flowering Time Regulation. Ellen L. Martin-Tryon, Joel A. Kreps, and Stacey L. Harmer

Continued on next page
Cold Transiently Activates Calcium-Permeable Channels in Arabidopsis Mesophyll Cells. **Armando Carpaneto, Natalya Ivashikina, Victor Lechenko, Elizbieta Krol, Elena Jeworutzki, Jian-Kang Zhu, and Rainer Hedrich** 487

Development and Hormone Action

Knockout of the AtCESA2 Gene Affects Microtubule Orientation and Causes Abnormal Cell Expansion in Arabidopsis. **Zhaoqing Chu, Hao Chen, Yiyue Zhang, Zhonghui Zhang, Nouyan Zheng, Bojiao Yin, Hongyan Yan, Lei Zhu, Xiangyu Zhao, Ming Yuan, Xiansheng Zhang, and Qi Xie** 213

Short Vegetative Phase-Like MADS-Box Genes Inhibit Floral Meristem Identity in Barley. **Ben Trevaskis, Million Tadege, Megan N. Hemming, W. James Peacock, Elizabeth S. Dennis, and Candice Sheldon** 225

Environmental Stress and Adaptation to Stress

Reciprocal Leaf and Root Expression of AtAmt1.1 and Root Architectural Changes in Response to Nitrogen Starvation. **Cawas B. Engineer and Robert G. Kranz** 236


Manganese Deficiency in Chlamydomonas Results in Loss of Photosystem II and MnSOD Function, Sensitivity to Peroxides, and Secondary Phosphorus and Iron Deficiency. **Michael D. Allen, Janette Kropat, Stephen Tottey, José A. Del Campo, and Sabeela S. Merchant** 263

Association of Specific Expansins with Growth in Maize Leaves Is Maintained under Environmental, Genetic, and Developmental Sources of Variation. **Bertrand Muller, Gildas Bourdais, Beat Reidy, Christelle Bencivenni, Agnès Massonneau, Pascal Condamine, Géaëlle Rolland, Geneviève Conéjéro, Peter Rogowsky, and François Tardieu** 278

Degradation of Oxidized Proteins by Autophagy during Oxidative Stress in Arabidopsis. **Yan Xiong, Anthony L. Contento, Phan Quang Nguyen, and Diane C. Bassham** 291

PsTRXh1 and PsTRXh2 Are Both Pea h-Type Thioredoxins with Antagonistic Behavior in Redox Imbalances. **José A. Traverso, Florence Vignols, Roland Cazalis, Amada Pulido, Mariam Sahrawy, Francisco Javier Cejudo, Yves Meyer, and Ana Chueca** 300


Germanium-68 as an Adequate Tracer for Silicon Transport in Plants. Characterization of Silicon Uptake in Different Crop Species. **Miroslav Nikolic, Nina Nikolic, Yongchao Liang, Ernest A. Kirkby, and Volker Römheld** 495

Genetics, Genomics, and Molecular Evolution

Transcriptome Analysis Reveals a Critical Role of CHS7 and CHS8 Genes for Isoflavonoid Synthesis in Soybean Seeds. **Sangeeta Dhaubhadel, Mark Gijzen, Pat Moy, and Mana Farhangkhoee** 326

MAIZEWALL. Database and Developmental Gene Expression Profiling of Cell Wall Biosynthesis and Assembly in Maize. **Sabine Guillaumie, Hélène San-Clemente, Caroline Deswarte, Yves Martinez, Catherine Lapierre, Alain Murigneux, Yves Barrie, Magalie Pichon, and Deborah Goffner** 339

Ecotropic Expression of a Basic Helix-Loop-Helix Gene Transactivates Parallel Pathways of Proanthocyanidin Biosynthesis. Structure, Expression Analysis, and Genetic Control of Leucomatocyanidin 4-Reductase and Anthocyanidin Reductase Genes in Lotus corniculatus. **Francesco Paolocci, Mark P. Robbins, Laura Maidó, Sergio Arcioni, Stefan Martens, and Francesco Damiani** 504

Plants Interacting with Other Organisms

A Phytophthora infestans Cystatin-Like Protein Targets a Novel Tomato Papain-Like Apoplastic Protease. **Miaoying Tian, Joe Win, Jing Song, Renier van der Hoorn, Esther van der Knaap, and Sophien Kamoun** 364

Continued on next page
Characterization of a Divinyl Ether Biosynthetic Pathway Specifically Associated with Pathogenesis in Tobacco. 
Alessandro Fammartino, Francesca Cardinale, Cornelia Göbel, Laurent Mène-Saffrané, Joëlle Fournier, Ivo Feussner, and Marie-Thérèse Esquerré-Tugayé

378

Tobacco Nectaries Express a Novel NADPH Oxidase Implicated in the Defense of Floral Reproductive Tissues against Microorganisms. 
Clay Carter, Rosanne Healy, Nicole M. O’Tool, S.M. Saqlan Naqvi, Gang Ren, Sanggyu Park, Gwyn A. Beattie, Harry T. Horner, and Robert W. Thornburg

389

AtERF14, a Member of the ERF Family of Transcription Factors, Plays a Nonredundant Role in Plant Defense. 
Luis Oriarte-Sánchez, Jonathan P. Anderson, Jodi Young, and Karam B. Singh

400

Steven G. Ralph, J.W. Hudgins, Sharon Janesik, Vincent R. Franceschi, and Jörg Bohlmann

410

Whole Plant and Ecophysiology

Dissection of the AtNRT2.1:AtNRT2.2 Inducible High-Affinity Nitrate Transporter Gene Cluster. 
Wenbin Li, Ye Wang, Mamoru Okamoto, Nigel M. Crawford, M. Yaeesh Siddiqi, and Anthony D.M. Glass

425

Genetic Variation Suggests Interaction between Cold Acclimation and Metabolic Regulation of Leaf Senescence. 
Céline Masclaux-Daubresse, Sarah Purdy, Thomas Lemaître, Nathalie Pourtau, Ludwine Taconnat, Jean-Pierre Renou, and Astrid Wingler

434

Physiological Roles of the Light, Oxygen, or Voltage Domains of Phototropin 1 and Phototropin 2 in Arabidopsis. 
Hae-Young Cho, Tong-Seung Tseng, Eirini Kaiserli, Stuart Sulcian, John M. Christie, and Winslow R. Briggs

517

Systems Biology, Molecular Biology, and Gene Regulation

MIKC* MADS-Protein Complexes Bind Motifs Enriched in the Proximal Region of Late Pollen-Specific Arabidopsis Promoters. 
Wim Verelst, Heinz Sauder, and Thomas Münster

447

Tobacco Isoenzyme 1 of NAD(H)-Dependent Glutamate Dehydrogenase Catabolizes Glutamate in Vivo. 
Matthew Peter Purnell and José Ramon Botella

530

Circadian Rhythms of Isoprene Biosynthesis in Grey Poplar Leaves. 
Maaria Loivamäki, Sandrine Louis, Gyöngyi Cinege, Ina Zimmer, Robert J. Fischbach, and Jörg-Peter Schnitzler

540

Some figures in this article are displayed in color online but in black and white in the print edition.

Indicates Web-only data.

Open Access articles can be viewed online without a subscription.