

T H E  
**PLANT**  
C E L L

Volume 31 Number 2 February 2019

The electronic form of this issue, available at [www.plantcell.org](http://www.plantcell.org), is the journal of record.

**ON THE COVER**



Photosynthetic performance of poplar trees is strengthened after recovery from mild drought-heat stress scenarios simulating predicted future climate conditions of the temperate zones. Georgii et al. (pp. 346–367) have investigated the changes that transcriptomes of different organs and wood tissues undergo during stress and after recovery. While stress responses were similar between a periodic and a chronic stress scenario, post-recovery gene regulation was highly specific both for stress scenario and plant tissue. The few transcription factors with shared expression profiles across different tissues included two homologs of *Arabidopsis* HOMEODOMAIN-LEUCINE ZIPPER PROTEIN 7 (HB7), which has been associated with an increased photosynthesis rate. The photo shows poplar trees in a plantation and was taken by Jörg-Peter Schnitzler, Helmholtz Zentrum München.

**IN BRIEF**

- Smashing Barriers in Biolistic Plant Transformation**<sup>[OPEN]</sup> 273  
Alex Harkess
- The Shade of Things to Come: Plastid Retrograde Signaling and Shade Avoidance**<sup>[OPEN]</sup> 275  
Patrice A. Salomé
- Meiocyte-specific Small RNAs and Meiotic Recombination: Questions and Answers**<sup>[OPEN]</sup> 276  
Jennifer Mach
- The Protein Phosphatase 4 Complex Functions in miRNA Biogenesis in *Arabidopsis***<sup>[OPEN]</sup> 278  
Reza K. Hammond
- 97 Shades of Gray: Genetic Interactions of the Gray Mold, *Botrytis cinerea*, with Wild and Domesticated Tomato**<sup>[OPEN]</sup> 280  
Emily Breeze

**REVIEW**

- The Regulation of Cellulose Biosynthesis in Plants** 282  
Joanna K. Polko and Joseph J. Kieber

**PERSPECTIVE**

- Engineering Strategies to Boost Crop Productivity by Cutting Respiratory Carbon Loss**<sup>[OPEN]</sup> 297  
Jeffrey S. Amthor, Arren Bar-Even, Andrew D. Hanson, A. Harvey Millar, Mark Stitt, Lee J. Sweetlove, and Stephen D. Tyerman

**BREAKTHROUGH REPORT**

- Plant Extracellular Vesicles Contain Diverse Small RNA Species and Are Enriched in 10- to 17-Nucleotide “Tiny” RNAs**<sup>[OPEN]</sup> 315  
Patricia Baldrich, Brian D. Rutter, Hana Zand Karimi, Ram Podicheti, Blake C. Meyers, and Roger W. Innes

**Editor in Chief**  
Sabeeha Merchant

**Senior Features Editor**  
Nancy A. Eckardt

**Features Editor**  
Mary Williams

**Science Editors**  
Greg Bertoni  
Kathleen L. Farquharson  
Nancy R. Hofmann  
Jennifer Lockhart  
Jennifer M. Mach

**Managing Editor**  
Jennifer A. Regala

**Production Manager**  
Susan L. Entwistle

**Manuscript Manager**  
Annette Kessler

**Publications Director**  
Nancy A. Winchester

**Publisher**  
American Society of  
Plant Biologists  
Executive Director,  
Crispin Taylor

**Editorial Office**  
15501 Monona Drive  
Rockville, Maryland 20855-2768  
Telephone: 301/296-0908

**Online at [www.plantcell.org](http://www.plantcell.org)**

## LARGE-SCALE BIOLOGY ARTICLES

- Phloem Companion Cell-Specific Transcriptomic and Epigenomic Analyses Identify MRF1, a Regulator of Flowering**<sup>[OPEN]</sup> 325  
Yuan You, Aneta Sawikowska, Joanne E. Lee, Ruben M. Benstein, Manuela Neumann, Pawel Krajewski, and Markus Schmid
- The Systems Architecture of Molecular Memory in Poplar after Abiotic Stress**<sup>[OPEN]</sup> 346  
Elisabeth Georgii, Karl Kugler, Matthias Pfeifer, Elisa Vanzo, Katja Block, Malgorzata A. Domagalska, Werner Jud, Hamada AbdElgawad, Han Asard, Richard Reinhardt, Armin Hansel, Manuel Spannagl, Anton R. Schäffner, Klaus Palme, Klaus F.X. Mayer, and Jörg-Peter Schnitzler

## RESEARCH ARTICLES

- Genome-Scale Sequence Disruption Following Biolistic Transformation in Rice and Maize**<sup>[OPEN]</sup> 368  
Jianing Liu, Natalie J. Nannas, Fang-fang Fu, Jinghua Shi, Brooke Aspinwall, Wayne A. Parrott, and R. Kelly Dawe
- Chloroplasts Modulate Elongation Responses to Canopy Shade by Retrograde Pathways Involving HY5 and Abscisic Acid** 384  
Miriam Ortiz-Alcaide, Ernesto Llamas, Aurelio Gomez-Cadenas, Akira Nagatani, Jaime F. Martínez-García, and Manuel Rodríguez-Concepción
- Interaction and Regulation Between Lipid Mediator Phosphatidic Acid and Circadian Clock Regulators** 399  
Sang-Chul Kim, Dmitri A. Nusinow, Maria L. Sorkin, Jose Pruneda-Paz, and Xuemin Wang
- Oscillating Aquaporin Phosphorylation and 14-3-3 Proteins Mediate the Circadian Regulation of Leaf Hydraulics**<sup>[OPEN]</sup> 417  
Karine Prado, Valérie Cotellet, Guowei Li, Jorge Bellati, Ning Tang, Colette Tournaire-Roux, Alexandre Martinière, Véronique Santoni, and Christophe Maurel
- The Histone H3K4 Demethylase JMJ16 Represses Leaf Senescence in Arabidopsis**<sup>[OPEN]</sup> 430  
Peng Liu, Shuaibin Zhang, Bing Zhou, Xi Luo, Xiao Feng Zhou, Bin Cai, Yin Hua Jin, De Niu, Jinxing Lin, Xiaofeng Cao, and Jing Bo Jin
- Meiocyte-Specific and AtSPO11-1-Dependent Small RNAs and Their Association with Meiotic Gene Expression and Recombination**<sup>[OPEN]</sup> 444  
Jiyue Huang, Cong Wang, Haifeng Wang, Pingli Lu, Binglian Zheng, Hong Ma, Gregory P. Copenhaver, and Yingxiang Wang
- Maize *Dek15* Encodes the Cohesin-Loading Complex Subunit SCC4 and Is Essential for Chromosome Segregation and Kernel Development**<sup>[OPEN]</sup> 465  
Yonghui He, Jinguang Wang, Weiwei Qi, and Rentao Song
- The PROTEIN PHOSPHATASE4 Complex Promotes Transcription and Processing of Primary microRNAs in Arabidopsis** 486  
Suikang Wang, Li Quan, Shaofang Li, Chenjiang You, Yong Zhang, Lei Gao, Liping Zeng, Lin Liu, Yanhua Qi, Beixin Mo, and Xuemei Chen
- Interactions of Tomato and *Botrytis cinerea* Genetic Diversity: Parsing the Contributions of Host Differentiation, Domestication, and Pathogen Variation** 502  
Nicole E. Soltis, Susanna Atwell, Gongjun Shi, Rachel Fordyce, Raoni Gwinner, Dihan Gao, Aysha Shafi, and Daniel J. Kliebenstein
- The Cotton Apoplastic Protein CRR1 Stabilizes Chitinase 28 to Facilitate Defense against the Fungal Pathogen *Verticillium dahliae*** 520  
Li-Bo Han, Yuan-Bao Li, Fu-Xin Wang, Wen-Yan Wang, Jun Liu, Jia-He Wu, Nai-Qin Zhong, Shen-Jie Wu, Gai-Li Jiao, Hai-Yun Wang, and Gui-Xian Xia

**Arabidopsis SME1 Regulates Plant Development and Response to Abiotic Stress by Determining Spliceosome Activity Specificity**

537

Raul Huertas, Rafael Catalá, José M. Jiménez-Gómez,  
M. Mar Castellano, Pedro Crevillén, Manuel Piñeiro, José A. Jarillo,  
and Julio Salinas

[OPEN] Articles can be viewed without a subscription.



© 2019 American Society of Plant Biologists. All rights reserved.

---

**The Plant Cell** (eISSN 1532-298X) is published monthly (one volume per year) by the American Society of Plant Biologists, 15501 Monona Drive, Rockville, MD 20855-2768, and is produced by Dartmouth Journal Services, Waterbury, VT. The institutional subscription price is based on type of institution; contact [institution@aspb.org](mailto:institution@aspb.org). Members of the American Society of Plant Biologists may subscribe to *The Plant Cell* for \$240. Nonmember individuals may subscribe for \$500. Students may subscribe for \$165. For matters regarding subscriptions, contact Suzanne Cholwek, ASPB, 15501 Monona Drive, Rockville, MD 20855-2768; telephone 301/296-0926; fax 301/251-6740; e-mail [scholwek@aspb.org](mailto:scholwek@aspb.org). Send all inquiries regarding display advertising to FASEB AdNet, 9650 Rockville Pike, Bethesda, MD 20814-3998; telephone 301/634-7791; fax 301/634-7153; e-mail [adnet@faseb.org](mailto:adnet@faseb.org). The online version of *The Plant Cell* is available at [www.plantcell.org](http://www.plantcell.org).

**Permission to Reprint:** Permission to make digital or hard copies of part or all of a work published in *The Plant Cell* is granted without fee for personal or classroom use provided that copies are not made or distributed for profit or commercial advantage and that copies bear the full citation and the following notice on the first page: "Copyright American Society of Plant Biologists." For all other kinds of copying, request permission in writing from Nancy A. Winchester, Publications Director, ASPB headquarters.

This information is current as of April 18, 2019

<b>Permissions</b>	<a href="https://www.copyright.com/ccc/openurl.do?sid=pd_hw1532298X&amp;issn=1532298X&amp;WT.mc_id=pd_hw1532298X">https://www.copyright.com/ccc/openurl.do?sid=pd_hw1532298X&amp;issn=1532298X&amp;WT.mc_id=pd_hw1532298X</a>
<b>eTOCs</b>	Sign up for eTOCs at: <a href="http://www.plantcell.org/cgi/alerts/ctmain">http://www.plantcell.org/cgi/alerts/ctmain</a>
<b>CiteTrack Alerts</b>	Sign up for CiteTrack Alerts at: <a href="http://www.plantcell.org/cgi/alerts/ctmain">http://www.plantcell.org/cgi/alerts/ctmain</a>
<b>Subscription Information</b>	Subscription Information for <i>The Plant Cell</i> and <i>Plant Physiology</i> is available at: <a href="http://www.aspb.org/publications/subscriptions.cfm">http://www.aspb.org/publications/subscriptions.cfm</a>