

T H E
PLANT
C E L L



CELEBRATING 25 YEARS

www.plantcell.org

T H E
PLANT
C E L L

Volume 26 Number 5 May 2014

The electronic form of this issue, available at www.plantcell.org, is the journal of record.

ON THE COVER



CELEBRATING 25 YEARS!
Happy Birthday to *The Plant Cell*!

EDITORIAL

- Twenty-Five Years Old: Happy Birthday to *The Plant Cell*!** 1831
Cathie Martin

IN BRIEF

- Walk into the Light Response: Direct Targets of Phytochrome A Include Genes That Respond to Light, Stress, and Hormones** 1832
Jennifer Mach

- Living in the Shadows: How Plants Balance Growth and Jasmonate-Dependent Defense Responses in the Shade** 1833
Jennifer Lockhart

- Genome Dominance and Interaction at the Gene Expression Level in Allohexaploid Wheat** 1834
Nancy A. Eckardt

- SAUR19 Links Auxin and Plasma Membrane H⁺-ATPases in Cell Expansion** 1835
Kathleen L. Farquharson

- The Importance of Being Absent: Auxin Minima Are Required for Axillary Meristem Formation** 1836
Nancy R. Hofmann

- Uncovering Male Germline Development in *Arabidopsis*: The Gametophyte Revealed** 1837
Jennifer Lockhart

PERSPECTIVES

- Tools and Strategies to Match Peptide-Ligand Receptor Pairs** [OPEN](#) 1838
Melinka A. Butenko, Mari Wildhagen, Markus Albert, Anna Jehle, Hubert Kalbacher, Reidunn B. Aalen, and Georg Felix

- Growth Control: A Saga of Cell Walls, ROS, and Peptide Receptors** 1848
Sebastian Wolf and Herman Höfte

LARGE-SCALE BIOLOGY ARTICLES

- Stitching together the Multiple Dimensions of Autophagy Using Metabolomics and Transcriptomics Reveals Impacts on Metabolism, Development, and Plant Responses to the Environment in *Arabidopsis*** [C|W](#) 1857
Céline Masclaux-Daubresse, Gilles Clément, Pauline Anne, Jean-Marc Routaboul, Anne Guiboileau, Fabienne Soulay, Ken Shirasu, and Kohki Yoshimoto

EDITORIAL BOARD

Editor in Chief

Cathie Martin

Coeditors

Sarah M. Assmann

Jody Banks

Alice Barkan

Sebastian Bednarek

James Birchler

Ulla Bonas

Christopher Bowler

Judy Callis

XiaoFeng Cao

Vincenzo De Luca

Xing Wang Deng

Xinnian Dong

Allan Downie

Alisdair Fernie

Pascal Genschik

Jean T. Greenberg

Thomas Guilfoyle

Herman R. Höfte

David Jackson

Regine Kahmann

Martin Kater

Daniel J. Kliebenstein

William Lucas

Blake Meyers

Ortrun Mittelsten Scheid

Giles Oldroyd

Michael Palmgren

Markus Pauly

Scott C. Peck

Barry Pogson

Zhaohui Qin

Karin Schumacher

David Smyth

Chris J. Staiger

Keiko Sugimoto

Managing Editor

Patti Lockhart

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

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

Fax: 301/279-2996

http://www.aspb.org

Online at www.plantcell.org

- mRNA and Small RNA Transcriptomes Reveal Insights into Dynamic Homeolog Regulation of Allopolyploid Heterosis in Nascent Hexaploid Wheat** [W|OPEN](#) 1878
Aili Li, Dengcai Liu, Jun Wu, Xubo Zhao, Ming Hao, Shuaifeng Geng, Jun Yan, Xiaoxue Jiang, Lianquan Zhang, Junyan Wu, Lingjie Yin, Rongzhi Zhang, Liang Wu, Youliang Zheng, and Long Mao
- Decreased Nucleotide and Expression Diversity and Modified Coexpression Patterns Characterize Domestication in the Common Bean** [W|OPEN](#) 1901
Elisa Bellucci, Elena Bitocchi, Alberto Ferrarini, Andrea Benazzo, Eleonora Biagetti, Sebastian Klie, Andrea Minio, Domenico Rau, Monica Rodriguez, Alex Panziera, Luca Venturini, Giovanna Attene, Emidio Albertini, Scott A. Jackson, Laura Nanni, Alisdair R. Fernie, Zoran Nikoloski, Giorgio Bertorelle, Massimo Delledonne, and Roberto Papa
- Large-Scale Proteomics of the Cassava Storage Root and Identification of a Target Gene to Reduce Postharvest Deterioration** [C|W|OPEN](#) 1913
Hervé Vanderschuren, Evans Nyaboga, Jacquelyne S. Poon, Katja Baerenfaller, Jonas Grossmann, Matthias Hirsch-Hoffmann, Norbert Kirchgessner, Paolo Nanni, and Wilhelm Gruissem
- ## RESEARCH ARTICLES
- Consequences of Whole-Genome Triplication as Revealed by Comparative Genomic Analyses of the Wild Radish *Raphanus raphanistrum* and Three Other Brassicaceae Species** [W|OPEN](#) 1925
Gaurav D. Moghe, David E. Hufnagel, Haibao Tang, Yongli Xiao, Ian Dworkin, Christopher D. Town, Jeffrey K. Conner, and Shin-Han Shiu
- The Origin and Biosynthesis of the Benzenoid Moiety of Ubiquinone (Coenzyme Q) in *Arabidopsis*** [W](#) 1938
Anna Block, Joshua R. Widhalm, Abdelhak Fatihi, Rebecca E. Cahoon, Yashitola Wamboldt, Christian Elowsky, Sally A. Mackenzie, Edgar B. Cahoon, Clint Chapple, Natalia Dudareva, and Gilles J. Basset
- Arabidopsis* Phytochrome A Directly Targets Numerous Promoters for Individualized Modulation of Genes in a Wide Range of Pathways** [W](#) 1949
Fang Chen, Bosheng Li, Gang Li, Jean-Benoit Charron, Mingqiu Dai, Xiarong Shi, and Xing Wang Deng
- Repression of Jasmonate-Dependent Defenses by Shade Involves Differential Regulation of Protein Stability of MYC Transcription Factors and Their JAZ Repressors in *Arabidopsis*** [C|W](#) 1967
José-Manuel Chico, Gemma Fernández-Barbero, Andrea Chini, Patricia Fernández-Calvo, Mónica Díez-Díaz, and Roberto Solano
- The RING-Finger E3 Ubiquitin Ligase COP1 SUPPRESSOR1 Negatively Regulates COP1 Abundance in Maintaining COP1 Homeostasis in Dark-Grown *Arabidopsis* Seedlings** [C|W|OPEN](#) 1981
Dongqing Xu, Fang Lin, Yan Jiang, Xi Huang, Jigang Li, Junjie Ling, Chamari Hettiarachchi, Christian Tellgren-Roth, Magnus Holm, and Xing Wang Deng
- PHYTOCHROME INTERACTING FACTOR1 Enhances the E3 Ligase Activity of CONSTITUTIVE PHOTOMORPHOGENIC1 to Synergistically Repress Photomorphogenesis in *Arabidopsis*** [C|W](#) 1992
Xiaosa Xu, Inyup Paik, Ling Zhu, Qingyun Bu, Xi Huang, Xing Wang Deng, and Enamul Huq
- Spatiotemporal Production of Reactive Oxygen Species by NADPH Oxidase Is Critical for Tapetal Programmed Cell Death and Pollen Development in *Arabidopsis*** [C|W](#) 2007
Hong-Tao Xie, Zhi-Yuan Wan, Sha Li, and Yan Zhang
- miR824*-Regulated AGAMOUS-LIKE16 Contributes to Flowering Time Repression in *Arabidopsis*** [C|W](#) 2024
Jin-Yong Hu, Yue Zhou, Fei He, Xue Dong, Liang-Yu Liu, George Coupland, Franziska Turck, and Juliette de Meaux
- A Zinc Finger Protein Regulates Flowering Time and Abiotic Stress Tolerance in Chrysanthemum by Modulating Gibberellin Biosynthesis** [C|W|OPEN](#) 2038
Yingjie Yang, Chao Ma, Yanjie Xu, Qian Wei, Muhammad Imtiaz, Haibo Lan, Shan Gao, Lina Cheng, Meiyang Wang, Zhangjun Fei, Bo Hong, and Junping Gao

The Stem Cell Niche in Leaf Axils Is Established by Auxin and Cytokinin in <i>Arabidopsis</i> W	2055
Ying Wang, Jin Wang, Bihai Shi, Ting Yu, Jiyan Qi, Elliot M. Meyerowitz, and Yuling Jiao	
Auxin Depletion from the Leaf Axil Conditions Competence for Axillary Meristem Formation in <i>Arabidopsis</i> and Tomato W I O P E N	2068
Quan Wang, Wouter Kohlen, Susanne Rossmann, Teva Vermoux, and Klaus Theres	
Activation of the Rab7 GTPase by the MON1-CCZ1 Complex Is Essential for PVC-to-Vacuole Trafficking and Plant Growth in <i>Arabidopsis</i> C I W	2080
Yong Cui, Qiong Zhao, Caiji Gao, Yu Ding, Yonglun Zeng, Takashi Ueda, Akihiko Nakano, and Liwen Jiang	
An EAR-Dependent Regulatory Module Promotes Male Germ Cell Division and Sperm Fertility in <i>Arabidopsis</i> C I W I O P E N	2098
Michael Borg, Nicholas Rutley, Sateesh Kagale, Yuki Hamamura, Mihai Gherghinoiu, Sanjeev Kumar, Ugur Sari, Manuel A. Esparza-Franco, Wataru Sakamoto, Kevin Rozwadowski, Tetsuya Higashiyama, and David Twell	
Bipolar Plasma Membrane Distribution of Phosphoinositides and Their Requirement for Auxin-Mediated Cell Polarity and Patterning in <i>Arabidopsis</i> W	2114
Ricardo Tejos, Michael Sauer, Steffen Vanneste, Miriam Palacios-Gomez, Hongjiang Li, Mareike Heilmann, Ringo van Wijk, Joop E.M. Vermeer, Ingo Heilmann, Teun Munnik, and Jiri Friml	
SAUR Inhibition of PP2C-D Phosphatases Activates Plasma Membrane H⁺-ATPases to Promote Cell Expansion in <i>Arabidopsis</i> C I W	2129
Angela K. Spartz, Hong Ren, Mee Yeon Park, Kristin N. Grandt, Sang Ho Lee, Angus S. Murphy, Michael R. Sussman, Paul J. Overvoorde, and William M. Gray	
The Novel Nuclear Envelope Protein KAKU4 Modulates Nuclear Morphology in <i>Arabidopsis</i> W	2143
Chieko Goto, Kentaro Tamura, Yoichiro Fukao, Tomoo Shimada, and Ikuko Hara-Nishimura	
Repair of Site-Specific DNA Double-Strand Breaks in Barley Occurs via Diverse Pathways Primarily Involving the Sister Chromatid W	2156
Giang T.H. Vu, Hieu X. Cao, Koichi Watanabe, Goetz Hensel, Frank R. Blattner, Jochen Kumlehn, and Ingo Schubert	
In Planta Recognition of a Double-Stranded RNA Synthesis Protein Complex by a Potexviral RNA Silencing Suppressor C I W I O P E N	2168
Yukari Okano, Hiroko Senshu, Masayoshi Hashimoto, Yutaro Neriya, Osamu Netsu, Nami Minato, Tetsuya Yoshida, Kensaku Maejima, Kenro Oshima, Ken Komatsu, Yasuyuki Yamaji, and Shigetou Namba	
HD-Zip Proteins GL2 and HDG11 Have Redundant Functions in <i>Arabidopsis</i> Trichomes, and GL2 Activates a Positive Feedback Loop via MYB23 W	2184
Aashima Khosla, Janet M. Paper, Allison P. Boehler, Amanda M. Bradley, Titus R. Neumann, and Kathrin Schrick	
Conditional Depletion of the <i>Chlamydomonas</i> Chloroplast ClpP Protease Activates Nuclear Genes Involved in Autophagy and Plastid Protein Quality Control W	2201
Silvia Ramundo, David Casero, Timo Mühlhaus, Dorothea Hemme, Frederik Sommer, Michèle Crèvecoeur, Michèle Rahire, Michael Schroda, Jannette Rusch, Ursula Goodenough, Matteo Pellegrini, Maria Esther Perez-Perez, José Luis Crespo, Olivier Schaad, Natacha Civic, and Jean David Rochaix	
Carotene Hydroxylase Activity Determines the Levels of Both α-Carotene and Total Carotenoids in Orange Carrots W	2223
Jacobo Arango, Matthieu Jourdan, Emmanuel Geoffriau, Peter Beyer, and Ralf Welsch	
<i>Arabidopsis</i> Transporter MGT6 Mediates Magnesium Uptake and Is Required for Growth under Magnesium Limitation W	2234
Dandan Mao, Jian Chen, Lianfu Tian, Zhenhua Liu, Lei Yang, Renjie Tang, Jian Li, Changqing Lu, Yonghua Yang, Jisen Shi, Liangbi Chen, Dongping Li, and Sheng Luan	

OPT3 Is a Phloem-Specific Iron Transporter That Is Essential for Systemic Iron Signaling and Redistribution of Iron and Cadmium in *Arabidopsis* ^W^O^P^E^N 2249

Zhiyang Zhai, Sheena R. Gayomba, Ha-il Jung, Nanditha K. Vimalakumari, Miguel Piñeros, Eric Craft, Michael A. Rutzke, John Danku, Brett Lahner, Tracy Punshon, Mary Lou Guerinot, David E. Salt, Leon V. Kochian, and Olena K. Vatamaniuk

***Colletotrichum orbiculare* Secretes Virulence Effectors to a Biotrophic Interface at the Primary Hyphal Neck via Exocytosis Coupled with SEC22-Mediated Traffic** ^W 2265

Hiroki Irieda, Hitomi Maeda, Kaoru Akiyama, Asuka Hagiwara, Hiromasa Saitoh, Aiko Uemura, Ryohei Terauchi, and Yoshitaka Takano

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

[Ⓦ] Online version contains Web-only data.

[ⓞ] Articles can be viewed online without a subscription.



© 2014 American Society of Plant Biologists. All rights reserved. Printed on acid-free paper effective with Volume 1, Number 1, January 1989. Printed in the United States of America.

The Plant Cell (ISSN 1040-4651, online ISSN 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 price for the print and online versions is based on type of institution; contact institution@aspb.org. Single copies may be purchased for \$40 each, plus \$10 shipping (U.S.) or \$12 (outside U.S.). 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. Notify ASPB in writing within 3 months (domestic) or 6 months (foreign) of issue date, and defective copies or copies lost in the mail will be replaced. 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. Periodicals postage paid at Rockville, MD 20850, and at additional mailing offices.

Postmaster: Send address changes to *The Plant Cell*, American Society of Plant Biologists, 15501 Monona Drive, Rockville, MD 20855-2768. The online version of *The Plant Cell* is available at 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.