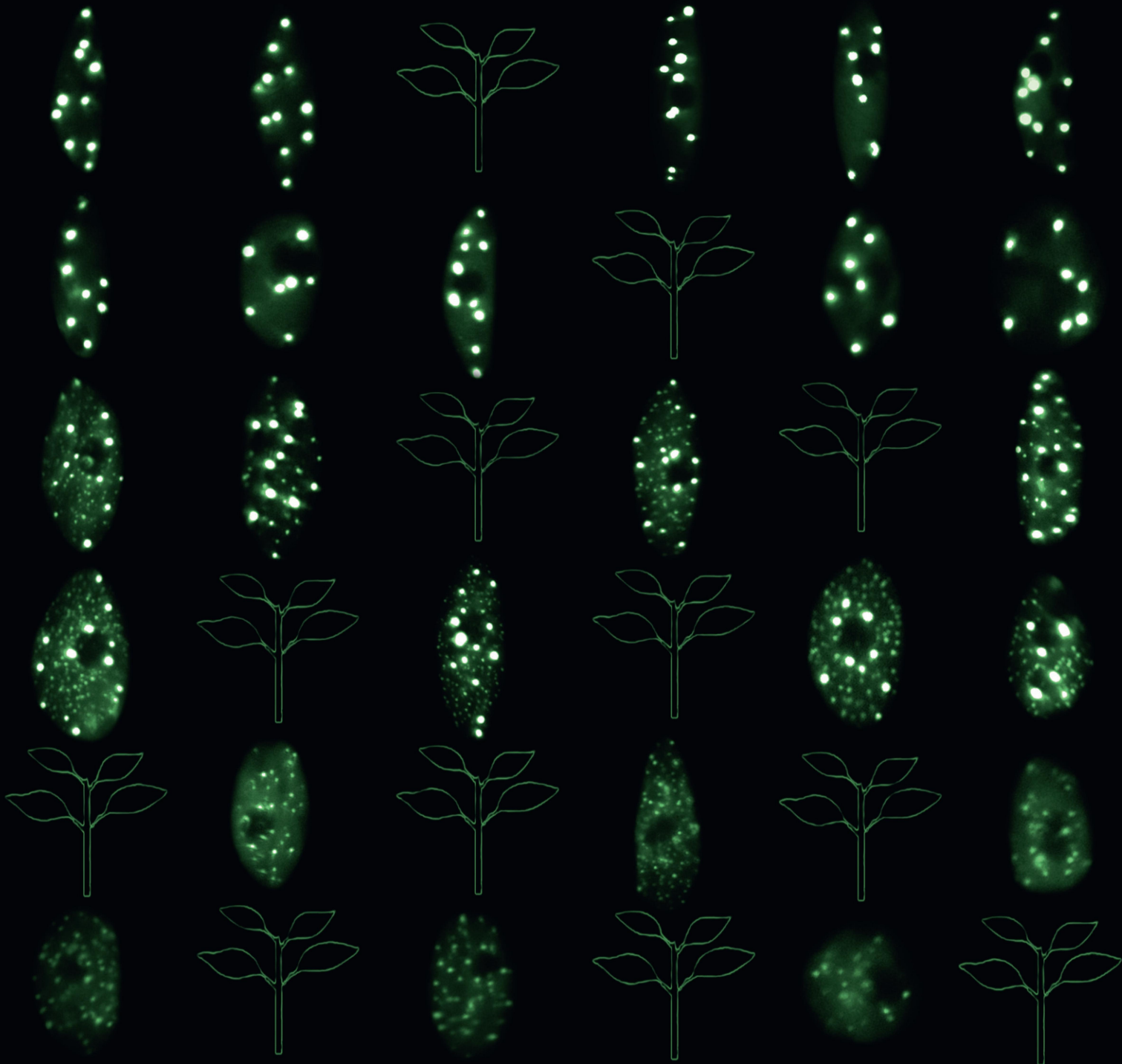


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**Phytochrome B under Shade**

The electronic form of this issue, available as of August 6, 2014, at [www.plantphysiol.org](http://www.plantphysiol.org), is considered the journal of record.

**On the Cover:** Green tissues strongly absorb red light more efficiently than far-red light. Therefore, neighboring vegetation lowers the red to far-red ratio (R:FR). This signal is perceived by phytochrome B, which mediates adaptive changes in plant body form and function. In this issue, Trupkin et al. (pp. 1698–1708) show that under high R:FR typical of open places, phytochrome B forms large nuclear bodies. The shift to low R:FR generates small phytochrome B nuclear bodies while causing some reduction in the diameter of large nuclear bodies. Trupkin et al. also show that reductions of red light irradiance without changes in R:FR cause similar changes in the size distribution of phytochrome B nuclear bodies and in plant growth. Therefore, phytochrome B not only perceives the changes in light quality (R:FR) but also the changes in light quantity (irradiance) caused by the shade of neighbors. The cover image shows the changes in phytochrome B nuclear bodies observed in response to increasing shade caused by higher plant densities. Cover image credits: Santiago Trupkin.

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## COMMENTARIES

Cellulase in Cellulose Synthase: A Cat among the Pigeons? *Takashi Ueda*

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## BREAKTHROUGH TECHNOLOGIES

[C][W][OPEN] Matching Patterns of Gene Expression to Mechanical Stiffness at Cell Resolution through Quantitative Tandem Epifluorescence and Nanoindentation. *Pascale Milani, Vincent Mirabet, Coralie Cellier, Frédérique Rozier, Olivier Hamant, Pradeep Das, and Arezki Boudaoud*

*Stem cells from the central zone in Arabidopsis shoot meristems exhibit an enhanced stiffness.*

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## RESEARCH REPORTS

[W][OPEN] The Pentatricopeptide Repeat Proteins TANG2 and ORGANELLE TRANSCRIPT PROCESSING439 Are Involved in the Splicing of the Multipartite *nad5* Transcript Encoding a Subunit of Mitochondrial Complex I. *Catherine Colas des Francs-Small, Andéol Falcon de Longevialle, Yunhai Li, Elizabeth Lowe, Sandra K. Tanz, Caroline Smith, Michael W. Bevan, and Ian Small*

*Two splicing factors of the multipartite mitochondrial nad5 transcript are pentatricopeptide repeat proteins.*

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## SCIENTIFIC CORRESPONDENCE

Trafficking of Vacuolar Sorting Receptors: New Data and New Problems. *David G. Robinson*

*Vacuolar sorting receptors bind cargo ligands early in the secretory pathway and show that multivesicular body-vacuole fusion requires a Rab5/Rab7 GTPase conversion with consequences for retromer binding.*

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## RESEARCH ARTICLES

### BIOCHEMISTRY AND METABOLISM

[W][OPEN] MYB5 and MYB14 Play Pivotal Roles in Seed Coat Polymer Biosynthesis in *Medicago truncatula*. *Chenggang Liu, Ji Hyung Jun, and Richard A. Dixon*

*myb5 and myb14 mutants have darker seed coats than the wild type, with myb5 having the stronger phenotypes.*

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*Continued on next page*

[W]Determination of the Structure and Catalytic Mechanism of *Sorghum bicolor* Caffeic Acid O-Methyltransferase and the Structural Impact of Three *brown midrib2* Mutations. *Abigail R. Green, Kevin M. Lewis, John T. Barr, Jeffrey P. Jones, Fachuang Lu, John Ralph, Wilfred Vermerris, Scott E. Sattler, and ChulHee Kang*

*The catalytic mechanism and substrate specificity of caffeic acid O-methyltransferase from Sorghum bicolor are deduced from crystal structures, site-directed mutagenesis, and kinetic and thermodynamic analyses.*

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[W][OPEN]Genetic Evidence That Chain Length and Branch Point Distributions Are Linked Determinants of Starch Granule Formation in *Arabidopsis*. *Barbara Pfister, Kuan-Jen Lu, Simona Eicke, Regina Feil, John E. Lunn, Sebastian Streb, and Samuel C. Zeeman*

*Glucose polymers with compatible branching patterns and chain length distributions are required to produce semicrystalline starch granules.*

1457

[W][OPEN]Genetic Determinants for Enzymatic Digestion of Lignocellulosic Biomass Are Independent of Those for Lignin Abundance in a Maize Recombinant Inbred Population. *Bryan W. Penning, Robert W. Sykes, Nicholas C. Babcock, Christopher K. Dugard, Michael A. Held, John F. Klimek, Jacob T. Shreve, Matthew Fowler, Angela Ziebell, Mark F. Davis, Stephen R. Decker, Geoffrey B. Turner, Nathan S. Mosier, Nathan M. Springer, Jyothi Thimmapuram, Clifford F. Weil, Maureen C. McCann, and Nicholas C. Carpita*

*Potential genetic determinants for enhancement of sugar yields from enzymatic digestion of maize biomass are unrelated to those for lignin abundance.*

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[C][W]Deoxyxylulose 5-Phosphate Synthase Controls Flux through the Methylerythritol 4-Phosphate Pathway in *Arabidopsis*. *Louvarance P. Wright, Johann M. Rohwer, Andrea Ghirardo, Almuth Hammerbacher, Miriam Ortiz-Alcaide, Bettina Raguschke, Jörg-Peter Schnitzler, Jonathan Gershenzon, and Michael A. Phillips*

*1-Deoxyxylulose 5-phosphate synthase is the controlling enzyme of plastid isoprenoid precursor biosynthesis in Arabidopsis.*

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[W][OPEN]Impairment in Sulfite Reductase Leads to Early Leaf Senescence in Tomato Plants. *Dmitry Yarmolinsky, Galina Brychkova, Assylay Kurmanbayeva, Aizat Bekturova, Yvonne Ventura, Inna Khozin-Goldberg, Amir Eppel, Robert Fluhr, and Moshe Sagi*

*Insufficient sulfite reductase activity activates the upstream components of the sulfate reduction pathway in tomato plants, resulting in accumulation of toxic sulfite and early leaf senescence.*

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## CELL BIOLOGY

[W]The Cellulase KORRIGAN Is Part of the Cellulose Synthase Complex. *Thomas Vain, Elizabeth Faris Crowell, Hélène Timpano, Eric Biot, Thierry Desprez, Nasim Mansoori, Luisa M. Trindade, Silvère Pagant, Stéphanie Robert, Herman Höfte, Martine Gonneau, and Samantha Vernhettes*

*An endo-1,4- $\beta$ -D-glucanase is part of the primary cell wall cellulose synthase complex (CSC) in the plasma membrane and plays a role in the trafficking of the CSC.*

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[C][W][OPEN]Dynamics of Male and Female Chromatin during Karyogamy in Rice Zygotes. *Yukinosuke Ohnishi, Rina Hoshino, and Takashi Okamoto*

*Chromatin from the rice egg nucleus initially moves into the sperm nucleus during karyogamy, which enlarges the latter before the male chromatin decondenses in nuclear fusion.*

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[W][OPEN] ABNORMAL POLLEN TUBE GUIDANCE1, an Endoplasmic Reticulum-Localized Mannosyltransferase Homolog of GLYCOSYLPHOSPHATIDYLINOSITOL10 in Yeast and PHOSPHATIDYLINOSITOL GLYCAN ANCHOR BIOSYNTHESIS B in Human, Is Required for Arabidopsis Pollen Tube Micropylar Guidance and Embryo Development. *Xin Ren Dai, Xin-Qi Gao, Guang Hui Chen, Li Li Tang, Hao Wang, and Xian Sheng Zhang*

*An Arabidopsis mannosyltransferase modulates micropylar guidance of pollen tube and early embryo development by processing and targeting of GPI-anchored proteins.*

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## ECOPHYSIOLOGY AND SUSTAINABILITY

[OPEN] Reversible Deformation of Transfusion Tracheids in *Taxus baccata* Is Associated with a Reversible Decrease in Leaf Hydraulic Conductance. *Yong-Jiang Zhang, Fulton E. Rockwell, James K. Wheeler, and N. Michele Holbrook*

*The reversible collapse of leaf transfusion tracheids of Taxus baccata under desiccation is related to reversible declines in leaf hydraulic conductance, suggesting a circuit breaker-like function that protects the xylem from excessive tensions.*

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[OPEN] Xyloglucan Endotransglucosylase-Hydrolase17 Interacts with Xyloglucan Endotransglucosylase-Hydrolase31 to Confer Xyloglucan Endotransglucosylase Action and Affect Aluminum Sensitivity in Arabidopsis. *Xiao Fang Zhu, Jiang Xue Wan, Ying Sun, Yuan Zhi Shi, Janet Braam, Gui Xin Li, and Shao Jian Zheng*

*A predicted xyloglucan endotransglucosylase (XET) protein interacts with a predicted xyloglucan endohydrolase protein to confer in vivo XET action and change the amount of aluminum retained in hemicellulose and aluminum sensitivity in Arabidopsis.*

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[C][W][OPEN] Phytochrome B Nuclear Bodies Respond to the Low Red to Far-Red Ratio and to the Reduced Irradiance of Canopy Shade in Arabidopsis. *Santiago Ariel Trupkin, Martina Legris, Ana Sabrina Buchovsky, María Belén Tolava Rivero, and Jorge José Casal*

*Phytochrome B nuclear bodies perceive not only the low red to far-red ratio, but also the low irradiance of canopy shade.*

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## GENES, DEVELOPMENT, AND EVOLUTION

[C][W] Polyamine Oxidase5 Regulates Arabidopsis Growth through Thermospermine Oxidase Activity. *Dong Wook Kim, Kanako Watanabe, Chihiro Murayama, Sho Izawa, Masaru Niitsu, Anthony J. Michael, Thomas Berberich, and Tomonobu Kusano*

*An Arabidopsis mutant with defective polyamine oxidase5 exhibits delayed transition from vegetative to reproductive growth caused by lack of thermospermine oxidation.*

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[W][OPEN] The MADS-Domain Factors AGAMOUS-LIKE15 and AGAMOUS-LIKE18, along with SHORT VEGETATIVE PHASE and AGAMOUS-LIKE24, Are Necessary to Block Floral Gene Expression during the Vegetative Phase. *Donna E. Fernandez, Chieh-Ting Wang, Yumei Zheng, Benjamin J. Adamczyk, Rajneesh Singhal, Pamela K. Hall, and Sharyn E. Perry*

*Elimination of four MADS-box genes leads to premature expression of floral genes in leaves.*

1591

[C][W] Functional and Evolutionary Analysis of the CASPARIAN STRIP MEMBRANE DOMAIN PROTEIN Family. *Daniele Roppolo, Brigitte Boeckmann, Alexandre Pfister, Emmanuel Boutet, Maria C. Rubio, Valérie Dénervaud-Tendon, Joop E.M. Vermeer, Jacqueline Gheyselinck, Ioannis Xenarios, and Niko Geldner*

*Casparian strip membrane proteins are potentially involved in the generation of plasma membrane domains and the modification of cell walls.*

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## MEMBRANES, TRANSPORT, AND BIOENERGETICS

[W]Proton Gradient Regulation5-Like1-Mediated Cyclic Electron Flow Is Crucial for Acclimation to Anoxia and Complementary to Nonphotochemical Quenching in Stress Adaptation. *Bernadeta Kukuczka, Leonardo Magneschi, Dimitris Petroustos, Janina Steinbeck, Till Bald, Marta Powikrowska, Christian Fufezan, Giovanni Finazzi, and Michael Hippler*

*Cyclic electron flow is essential for survival under high light and anoxic conditions.* 1604

[W]Phycobilisome Mobility and Its Role in the Regulation of Light Harvesting in Red Algae. *Radek Kaňa, Eva Kotabová, Martin Lukeš, Štěpán Papáček, Ctirad Matonoha, Lu-Ning Liu, Ondřej Prášil, and Conrad W. Mullineaux*

*Phycobilisomes are mobile in mesophilic and immobile in extremophilic red algae, affecting photoprotection and either state transitions or nonphotochemical quenching.* 1618

[W][OPEN]Inducible Repression of Nuclear-Encoded Subunits of the Cytochrome  $b_6/f$  Complex in Tobacco Reveals an Extraordinarily Long Lifetime of the Complex. *Marta Hojka, Wolfram Thiele, Szilvia Z. Tóth, Wolfgang Lein, Ralph Bock, and Mark Aurel Schöttler*

*De novo biogenesis of the cytochrome  $b_6/f$  complex is restricted to young leaves of tobacco.* 1632

## SIGNALING AND RESPONSE

[C][W][OPEN]The S-Domain Receptor Kinase Arabidopsis Receptor Kinase2 and the U Box/Armadillo Repeat-Containing E3 Ubiquitin Ligase9 Module Mediates Lateral Root Development under Phosphate Starvation in Arabidopsis. *Srijani Deb, Subramanian Sankaranarayanan, Gayathri Wewala, Ellen Widdup, and Marcus A. Samuel*

*Autophagy plays an important role during lateral root development under phosphate starvation.* 1647

[W][OPEN]BOTRYTIS-INDUCED KINASE1 Modulates Arabidopsis Resistance to Green Peach Aphids via PHYTOALEXIN DEFICIENT4. *Jiaxin Lei, Scott A. Finlayson, Ron A. Salzman, Libo Shan, and Keyan Zhu-Salzman*

*Rapid HR-like cell death confers plant resistance to aphids.* 1657

[C][W]TGA Transcription Factors Activate the Salicylic Acid-Suppressible Branch of the Ethylene-Induced Defense Program by Regulating ORA59 Expression. *Mark Zander, Corinna Thurow, and Christiane Gatz*

*Two antagonistic hormonal pathways merge at the promoter of a crucial activator of one of the pathways.* 1671

[C][W][OPEN]Water Balance, Hormone Homeostasis, and Sugar Signaling Are All Involved in Tomato Resistance to Tomato Yellow Leaf Curl Virus. *Dagan Sade, Nir Sade, Oz Shriki, Stephen Lerner, Alem Gebremedhin, Asaf Karavani, Yario Brotman, Sonia Osorio, Alisdair R. Fernie, Lothar Willmitzer, Henryk Czosnek, and Menachem Moshelion*

*Tonoplast water channels contribute to Tomato yellow leaf curl virus resistance through hormone homeostasis and sugar signaling.* 1684

[C][W][OPEN]Conditional Auxin Response and Differential Cytokinin Profiles in Shoot Branching Mutants. *Naomi F. Young, Brett J. Ferguson, Ioanna Antoniadis, Mark H. Bennett, Christine A. Beveridge, and Colin G.N. Turnbull*

*Transcript and hormone profiles suggest that differential cytokinin supply may explain the conditional bud growth response to applied auxin in strigolactone-deficient branching mutants.* 1723

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[C][W] Scaffold Function of Ca<sup>2+</sup>-Dependent Protein Kinase: Tobacco Ca<sup>2+</sup>-DEPENDENT PROTEIN KINASE1 Transfers 14-3-3 to the Substrate REPRESSION OF SHOOT GROWTH after Phosphorylation. *Takeshi Ito, Masaru Nakata, Jutarou Fukazawa, Sarahmi Ishida, and Yohsuke Takahashi*

*A Ca<sup>2+</sup>-dependent protein kinase not only phosphorylates a substrate but also acts as a scaffold that promotes the interaction between a phosphorylation product and its binding protein.*

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