On the Cover: The cover depicts symbiotic arbuscular mycorrhizal (AM) fungus *Rhizophagus irregularis* in *Lotus japonicus* roots. AM symbiosis is a mutualistic interaction that supplies the plant with inorganics, including phosphate and nitrate, and the fungus with photosynthetic products. The fungus enters and affects hyphae (blue) within the host root, forming symbiotic vesicles (red) and arbuscules (green) to facilitate material exchange between the host and the fungus. Takeda et al. (pp. 545–557) describe a role for the phytohormone GA in AM symbiosis, including an up-regulation of GA synthesis and its accumulation in the root. The fungal structures shown were stained with Wheat Germ Agglutinin-Alexafluor 594 for confocal microscopy, and images were rendered to generate these three-dimensional projections. Cover image credits: Naoya Takeda (National Institute for Basic Biology, Division of Symbiotic Systems).

ON THE INSIDE

Peter V. Minorsky

SCIENTIFIC CORRESPONDENCE

OPEN ALL NIGHT LONG: The Dark Side of Stomatal Control. J. Miguel Costa, Fabien Monnet, Dorothee Jannaud, Nathalie Leondhardt, Brigitte Ksas, Ilja M. Reiter, Florent Pantin, and Bernard Genty

Isolation of Arabidopsis mutants that maintain stomata open all night long credits the existence of dedicated regulators for stomatal closure in darkness.

UPDATES

Regulation of Specialized Metabolism by WRKY Transcription Factors. Craig Schluttenhofer and Ling Yuan

WRKY transcription factors play an essential role in regulating the biosynthesis of plant-specialized metabolites.

RESEARCH ARTICLES

BIOCHEMISTRY AND METABOLISM

[OPEN] Pepper Heat Shock Protein 70a Interacts with the Type III Effector AvrBsT and Triggers Plant Cell Death and Immunity. Nak Hyun Kim and Byung Kook Hwang

A pepper heat shock protein acts as a positive regulator of plant cell death and immunity signaling in response to heat stress and microbial pathogens.

[OPEN] The Exosome and Trans-Acting Small Interfering RNAs Regulate Cuticular Wax Biosynthesis during Arabidopsis Inflorescence Stem Development. Patricia Lam, Lifang Zhao, Nathan Eveleigh, Yu Yu, Xuemei Chen, and Ljerka Kunst

The exosome and small RNAs control Arabidopsis cuticular wax biosynthesis.

[OPEN] Down-Regulation of Kelch Domain-Containing F-Box Protein in Arabidopsis Enhances the Production of (Poly)phenols and Tolerance to Ultraviolet Radiation. Xuebin Zhang, Mingyue Guo, Chunrong Guo, Huijun Yang, and Chang-Jun Liu

Kelch repeat F-box proteins physically interact with phenylpropanoid biosynthetic enzymes, and regulate the production of (poly)phenolics and plant tolerance to ultraviolet irradiation.

Two Activities of Long-Chain Acyl-Coenzyme A Synthetase Are Involved in Lipid Trafficking between the Endoplasmic Reticulum and the Plastid in Arabidopsis. Dirk Jessen, Charlotte Roth, Marcel Wiermer, and Martin Fulda

Lipid reassembly is a key step in the transfer of cytosolic lipid precursors to the plastid.

Continued on next page
CELL BIOLOGY


Modifying homogalacturonans in the intine cell wall during maturation of the pollen grain is central for proper germination. 367


The compound CESTRIN reduces cellulose content and inhibits the trafficking of CESA in Arabidopsis hypocotyls. 381

[OPEN] DEVELOPMENTALLY REGULATED PLASMA MEMBRANE PROTEIN of Nicotiana benthamiana Contributes to Potyvirus Movement and Transports to Plasmodesmata via the Early Secretory Pathway and the Actomyosin System. Chao Geng, Qian-Qian Cong, Xiang-Dong Li, An-Li Mou, Rui Gao, Jin-Liang Liu, and Yan-Ping Tian

Virus movement in tobacco depends on interactions between tobacco and viral movement proteins and on their traffic to plasmodesmata. 394

ECOPHYSIOLOGY AND SUSTAINABILITY

A Wheat CCAAT Box-Binding Transcription Factor Increases the Grain Yield of Wheat with Less Fertilizer Input. Baoyuan Qu, Xue He, Jing Wang, Yanqun Zhao, Wan Teng, An Shao, Xueqiang Zhao, Wenyong Ma, Junyi Wang, Bin Li, Zhenzheng Li, and Yiping Tong

The transcription factor TaNFYA-B1 is up-regulated by low-nitrogen and low-phosphorus treatment in wheat seedlings, and overexpressing this gene increases the grain yield of wheat under differing nitrogen and phosphorus supply levels. 411

GENES, DEVELOPMENT, AND EVOLUTION


A homeobox gene key for plant development is regulated at the transcriptional, posttranscriptional, and posttranslational levels. 424


A duplicated pair of transcription factors control cell patterning and cell differentiation in maize endosperm development. 443

MEMBRANES, TRANSPORT, AND BIOENERGETICS

High Light-Dependent Phosphorylation of Photosystem II Inner Antenna CP29 in Monocots Is STN7 Independent and Enhances Nonphotochemical Quenching. Nico Betterle, Matteo Ballottari, Sacha Baginsky, and Roberto Bassi

Phosphorylation of a monomeric antenna protein correlates with increased photoprotective energy dissipation in monocots and is controlled by distinct enzymes compared with trimeric major antennae. 457

Continued on next page

Two iron-bound flavodoxin-domain proteins mediate an oxygen-dependent alternative electron flow in the cyanobacterium Synechocystis under CO₂-limited conditions.

PHOTOSYSTEM II PROTEIN33, a Protein Conserved in the Plastid Lineage, Is Associated with the Chloroplast Thylakoid Membrane and Provides Stability to Photosystem II Supercomplexes in Arabidopsis. Rikard Fristedt, Andrei Herdean, Cristen E. Blaby-Haas, Fikret Mamedov, Sabeeha S. Merchant, Robert L. Last, and Björn Lundin

The study of a previously undescribed protein shows its involvement in the maintenance of the photosystem II light-harvesting supercomplex.

PROTEIN PHOSPHATASE 2A HOLOENZYME IS TARGETED TO PEROXISOMES BY PIGGYBACKING AND POSITIVELY AFFECTS PEROXISOMAL β-OXIDATION. Amr R.A. Kataya, Behzad Heidari, Lars Hagen, Roald Kommedal, Geir Slupphaug, and Cathrine Lillo

Protein phosphatase 2A targets peroxisomes and positively affects fatty acid oxidation.

Arabidopsis Receptor of Activated C Kinase1 Phosphorylation by WITH NO LYSINE8 KINASE. Daisuke Urano, Olaf Czarnecki, Xiaoping Wang, Alan M. Jones, and Jin-Gui Chen

Phosphorylation of a scaffold protein negatively regulates its function by affecting protein stability.

Thermoperiodic Control of Hypocotyl Elongation Depends on Auxin-Induced Ethylene Signaling That Controls Downstream PHYTOCHROME INTERACTING FACTOR3 Activity. Ralph Bours, Wouter Kohlen, Harro J. Bournmeester, and Alexander van der Krol

Antiphase light and temperature cycles disrupt an auxin-ethylene-induced signaling cascade, leading to reduced hypocotyl elongation.


A single mechanism exists of gibberellin perception for gene expression in rice aleurone cells.

Gibberellins Interfere with Symbiosis Signaling and Gene Expression and Alter Colonization by Arbuscular Mycorrhizal Fungi in Lotus japonicus. Naoya Takeda, Yoshihiro Handa, Syusaku Tsuzuki, Mikiko Kojima, Hitoshi Sakakibara, and Masayoshi Kawaguchi

Gibberellin signaling is enhanced by, and exerts positive and negative effects on, arbuscular mycorrhiza development by interfering with symbiotic signaling and gene expression.


Nitrogen deprivation induces orderly, multilevel down-regulation of the photosynthetic apparatus, energy capture, and carbon fixation.

The benefits of a photorespiratory bypass depend on its metabolic and chloroplast membrane diffusion properties.

Genome-based Metabolic Mapping and $^{13}$C Flux Analysis Reveal Systematic Properties of an Oleaginous Microalga Chlorella protothecoides.  Chao Wu, Wei Xiong, Junbiao Dai, and Qingyu Wu

Integrated flux balance analysis accurately reconstructs phototrophic and heterotrophic metabolism in Chlorella protothecoides.