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On the Cover: Aphids (Hemiptera: Aphididae) are phloem sap-feeding insects that are important pests of plants. Also, several aphids vector plant viral diseases. Aphids utilize their slender stylets, which are modified mouthparts, to consume phloem sap from sieve elements. As depicted in this illustration, the flexible stylet follows an intercellular path to the sieve elements, thereby minimizing wounding damage to plant tissues. Both antixenotic and antibiotic mechanisms contribute to host defenses against aphids. Antixenotic factors impact insect behavior, for example, the aphid's ability to find and feed from sieve elements. In comparison, antibiotic factors impact aphid physiology, resulting in adverse effects on insect growth, development, and/or reproduction. The interaction between *Arabidopsis* (*Arabidopsis thaliana*) and green peach aphid (GPA; *Myzus persicae*) identified *Arabidopsis* *PHYTOALEXIN-DEFICIENT4* (*PAD4*) as an important modulator of antixenotic and antibiotic defenses against GPA. *PAD4* encodes a protein with homology to α/β -fold acyl hydrolases that include lipases and esterases. *PAD4* is also a component of *Arabidopsis* defense against pathogens operating with its interacting partner ENHANCED DISEASE SUSCEPTIBILITY1 (*EDS1*). However, *EDS1* is not required for *PAD4*'s involvement in defense against GPA. In this issue, Louis et al. (pp. 1860–1872) demonstrate that mutation of a conserved Ser (S118) in the predicted lipase active site of *PAD4* permits the discrimination of *PAD4* activities in defense against GPA, suggesting that *PAD4* is capable of adopting a number of molecularly and mechanistically different forms, which determine different functions of *PAD4* in fighting aphid infestation. Cover image by Nick Sloff (University Park, PA). The cover image by Nick Sloff includes an aphid image adapted from a drawing by Thomas Degen (www.thomas-degen.ch) and an image of plant cells adapted from a drawing by Kerry Mauck.

ON THE INSIDE

Peter V. Minorsky

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GENOME ANALYSIS

[C][W][OA] Exploring Tomato Gene Functions Based on Coexpression Modules Using Graph Clustering and Differential Coexpression Approaches. Atsushi Fukushima, Tomoko Nishizawa, Mariko Hayakumo, Shoko Hikosaka, Kazuki Saito, Eiji Goto, and Miyako Kusano

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[W][OA] A Novel Method of Transgene Delivery into Triticale Plants Using the *Agrobacterium* Transferred DNA-Derived Nano-Complex. Alicja Ziemienowicz, Youn-Seb Shim, Aki Matsuoka, Francois Eudes, and Igor Kovalchuk

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[W][OA] Cellular Force Microscopy for in Vivo Measurements of Plant Tissue Mechanics. Anne-Lise Routier-Kierzkowska, Alain Weber, Petra Kochova, Dimitris Felekis, Bradley J. Nelson, Cris Kuhlemeier, and Richard S. Smith

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[C][W][OA] ANAP: An Integrated Knowledge Base for *Arabidopsis* Protein Interaction Network Analysis. Congmao Wang, Alex Marshall, Dabing Zhang, and Zoe A. Wilson

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[C][W][OA] Matapax: An Online High-Throughput Genome-Wide Association Study Pipeline. Liam H. Childs, Jan Lisec, and Dirk Walther

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SCIENTIFIC CORRESPONDENCE

Mutant Flower Morphologies in the Wind Orchid, a Novel Orchid Model Species. Sascha Duttke, Nicholas Zoulias, and Minsung Kim

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RESEARCH ARTICLES

BIOCHEMICAL PROCESSES AND MACROMOLECULAR STRUCTURES

- [W][OA] The Maize Tapetum Employs Diverse Mechanisms to Synthesize and Store Proteins and Flavonoids and Transfer Them to the Pollen Surface. *Yubing Li, Der Fen Suen, Chien-Yu Huang, Shung-Yee Kung, and Anthony H.C. Huang* 1548–1561
- [W][OA] A Lipid Droplet Protein of *Nannochloropsis* with Functions Partially Analogous to Plant Oleosins. *Astrid Vieler, Shane B. Brubaker, Bertrand Vick, and Christoph Benning* 1562–1569
- [W][OA] Amino Acid Residues Critical for the Specificity for Betaine Aldehyde of the Plant ALDH10 Isoenzyme Involved in the Synthesis of Glycine Betaine. *Ángel G. Díaz-Sánchez, Lilian González-Segura, Carlos Mújica-Jiménez, Enriquer Rudiño-Piñera, Carmina Montiel, León P Martínez-Castilla, and Rosario A. Muñoz-Clares* 1570–1582
- [C][W] Subclassification and Biochemical Analysis of Plant Papain-Like Cysteine Proteases Displays Subfamily-Specific Characteristics. *Kerstin H. Richau, Farnusch Kaschani, Martijn Verdoes, Twinkal C. Pansuriya, Sherry Niessen, Kurt Stüber, Tom Colby, Hermen S. Overkleeft, Matthew Bogyo, and Renier A.L. Van der Hoorn* 1583–1599
- [C][W] Natural Hypolignification Is Associated with Extensive Oligolignol Accumulation in Flax Stems. *Rudy Huis, Kris Morreel, Ophélie Fliniaux, Anca Lucau-Danila, Stéphane Fénart, Sébastien Grec, Godfrey Neutelings, Brigitte Chabbert, François Mesnard, Wout Boerjan, and Simon Hawkins* 1893–1915
- [C][W][OA] Prunasin Hydrolases during Fruit Development in Sweet and Bitter Almonds. *Raquel Sánchez-Pérez, Fara Sáez Belmonte, Jonas Borch, Federico Dicenta, Birger Lindberg Møller, and Kirsten Jørgensen* 1916–1932
- [C][W][OA] A Revised Architecture of Primary Cell Walls Based on Biomechanical Changes Induced by Substrate-Specific Endoglucanases. *Yong Bum Park and Daniel J. Cosgrove* 1933–1943
- [W][OA] The Phosphatidylcholine Diacylglycerol Cholinephosphotransferase Is Required for Efficient Hydroxy Fatty Acid Accumulation in Transgenic Arabidopsis. *Zhaohui Hu, Zhonghai Ren, and Chaofu Lu* 1944–1954

BIOENERGETICS AND PHOTOSYNTHESIS

- [C][W] Photosynthetic Pigment Localization and Thylakoid Membrane Morphology Are Altered in *Synechocystis* 6803 Phycobilisome Mutants. *Aaron M. Collins, Michelle Liberton, Howland D.T. Jones, Omar F. Garcia, Himadri B. Pakrasi, and Jerilyn A. Timlin* 1600–1609
- [W][OA] Nucleotide and RNA Metabolism Prime Translational Initiation in the Earliest Events of Mitochondrial Biogenesis during Arabidopsis Germination. *Simon R. Law, Reena Narsai, Nicolas L. Taylor, Etienne Delannoy, Chris Carrie, Estelle Giraud, A. Harvey Millar, Ian Small, and James Whelan* 1610–1627

CELL BIOLOGY AND SIGNAL TRANSDUCTION

- [C][W][OA] The Ubiquitin E3 Ligase LOSS OF GDU2 Is Required for GLUTAMINE DUMPER1-Induced Amino Acid Secretion in Arabidopsis. *Réjane Pratelli, Damian D. Guerra, Shi Yu, Mark Wogulis, Edward Kraft, Wolf B. Frommer, Judy Callis, and Guillaume Pilot* 1628–1642
- [W][OA] *Silques Are Red1* from Arabidopsis Acts as a Bidirectional Amino Acid Transporter That Is Crucial for the Amino Acid Homeostasis of Siliques. *Friederike Ladwig, Mark Stahl, Uwe Ludewig, Axel A. Hirner, Ulrich Z. Hammes, Ruth Stadler, Klaus Harter, and Wolfgang Koch* 1643–1655
- [C][W][OA] The Amino-Terminal Domain of Chloroplast Hsp93 Is Important for Its Membrane Association and Functions in Vivo. *Chiung-Chih Chu and Hsou-min Li* 1656–1665
- [W][OA] Characterization of Genes Involved in Cytokinin Signaling and Metabolism from Rice. *Yu-Chang Tsai, Nicholas R. Weir, Kristine Hill, Wenjing Zhang, Hyo Jung Kim, Shin-Han Shiu, G. Eric Schaller, and Joseph J. Kieber* 1666–1684
- [C][W][OA] Regulatory Functions of SnRK1 in Stress-Responsive Gene Expression and in Plant Growth and Development. *Young-Hee Cho, Jung-Woo Hong, Eun-Chul Kim, and Sang-Dong Yoo* 1955–1964
- [C][W][OA] Arabidopsis Hexokinase-Like1 and Hexokinase1 Form a Critical Node in Mediating Plant Glucose and Ethylene Responses. *Abhijit Karve, Xiaoxia Xia, and Brandon d. Moore* 1965–1975

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DEVELOPMENT AND HORMONE ACTION

- [W][OA] Poppy *APETALA1/FRUITFULL* Orthologs Control Flowering Time, Branching, Perianth Identity, and Fruit Development. *Natalia Pabón-Mora, Barbara A. Ambrose, and Amy Litt* 1685–1704
- [C][W][OA] Reactive Oxygen Species Are Involved in Gibberellin/Abscisic Acid Signaling in Barley Aleurone Cells. *Yushi Ishibashi, Tomoya Tawaratsumida, Koji Kondo, Shinsuke Kasa, Masatsugu Sakamoto, Nozomi Aoki, Shao-Hui Zheng, Takashi Yuasa, and Mari Iwaya-Inoue* 1705–1714
- [C][W] Role of cis-12-Oxo-Phytodienoic Acid in Tomato Embryo Development. *Stephan Goetz, Anja Hellwege, Irene Stenzel, Claudia Kutter, Valeska Hauptmann, Susanne Forner, Bonnie McCaig, Gerd Hause, Otto Miersch, Claus Wasternack, and Bettina Hause* 1715–1727
- [W][OA] Recycling of Methylthioadenosine Is Essential for Normal Vascular Development and Reproduction in Arabidopsis. *Ishari Waduware-Jayabahu, Yasmin Oppermann, Markus Wirtz, Zachary T. Hull, Sarah Schoor, Alexander N. Plotnikov, Rüdiger Hell, Margret Sauter, and Barbara A. Moffatt* 1728–1744
- [C][W][OA] Strigolactones Suppress Adventitious Rooting in Arabidopsis and Pea. *Amanda Rasmussen, Michael Glenn Mason, Carolien De Cuyper, Philip B. Brewer, Silvia Herold, Javier Agusti, Danny Geelen, Thomas Greb, Sofie Goormachtig, Tom Beeckman, and Christine Anne Beveridge* 1976–1987
- [C][W][OA] Transport of Indole-3-Butyric Acid and Indole-3-Acetic Acid in Arabidopsis Hypocotyls Using Stable Isotope Labeling. *Xing Liu, Lana Barkawi, Gary Gardner, and Jerry D. Cohen* 1988–2000

ENVIRONMENTAL STRESS AND ADAPTATION TO STRESS

- Identification of Candidate Genes Underlying an Iron Efficiency Quantitative Trait Locus in Soybean. *Gregory A. Peiffer, Keith E. King, Andrew J. Severin, Gregory D. May, Silvia R. Cianzio, Shun Fu Lin, Nicholas C. Lauter, and Randy C. Shoemaker* 1745–1754
- [C][W][OA] Constitutive Activation of Transcription Factor OsbZIP46 Improves Drought Tolerance in Rice. *Ning Tang, Hua Zhang, Xianghua Li, Jinghua Xiao, and Lizhong Xiong* 1755–1768
- [W][OA] SCARECROW Has a SHORT-ROOT-Independent Role in Modulating the Sugar Response. *Hongchang Cui, Yueling Hao, and Danyu Kong* 1769–1778
- [C][W] Fission Yeast HMT1 Lowers Seed Cadmium through Phytochelatin-Dependent Vacuolar Sequestration in Arabidopsis. *Jing Huang, Yu Zhang, Jia-Shi Peng, Chen Zhong, Hong-Ying Yi, David W. Ow, and Ji-Ming Gong* 1779–1788

GENETICS, GENOMICS, AND MOLECULAR EVOLUTION

- [C][W][OA] Analysis of *Porphyra* Membrane Transporters Demonstrates Gene Transfer among Photosynthetic Eukaryotes and Numerous Sodium-Coupled Transport Systems. *Cheong Xin Chan, Simone Zäuner, Glen Wheeler, Arthur R. Grossman, Simon E. Prochnik, Nicolas A. Blouin, Yunyun Zhuang, Christoph Benning, Gry Mine Berg, Charles Yarish, Renée L. Eriksen, Anita S. Klein, Senjie Lin, Ira Levine, Susan H. Brawley, and Debashish Bhattacharya* 2001–2012

PLANTS INTERACTING WITH OTHER ORGANISMS

- [C][W][OA] Phytosterols Play a Key Role in Plant Innate Immunity against Bacterial Pathogens by Regulating Nutrient Efflux into the Apoplast. *Keri Wang, Muthappa Senthil-Kumar, Choong-Min Ryu, Li Kang, and Kirankumar S. Mysore* 1789–1802
- [W][OA] Type III Secretion and Effectors Shape the Survival and Growth Pattern of *Pseudomonas syringae* on Leaf Surfaces. *Jiyoung Lee, Gail M. Teitzel, Kathy Munkvold, Olga del Pozo, Gregory B. Martin, Richard W. Michelmore, and Jean T. Greenberg* 1803–1818
- [W][OA] Structure-Function Analysis of the Coiled-Coil and Leucine-Rich Repeat Domains of the RPS5 Disease Resistance Protein. *Dong Qi, Brody J. DeYoung, and Roger W. Innes* 1819–1832
- [C][W][OA] Brassinosteroids Antagonize Gibberellin- and Salicylate-Mediated Root Immunity in Rice. *David De Vleeschauwer, Evelien Van Buyten, Kouji Satoh, Johnny Balidion, Ramil Mauleon, Il-Ryong Choi, Casiana Vera-Cruz, Shoshi Kikuchi, and Monica Höfte* 1833–1846

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- ^{[W][OA]}SR1, a Calmodulin-Binding Transcription Factor, Modulates Plant Defense and Ethylene-Induced Senescence by Directly Regulating *NDR1* and *EIN3*. *Haozhen Nie, Chunzhao Zhao, Guangheng Wu, Yingying Wu, Yongfang Chen, and Dingzhong Tang* 1847–1859
- ^{[W][OA]}Discrimination of Arabidopsis *PAD4* Activities in Defense against Green Peach Aphid and Pathogens. *Joe Louis, Enrico Gobbato, Hossain A. Mondal, Bart J. Feys, Jane E. Parker, and Jyoti Shah* 1860–1872
- ^{[W][OA]}A Peroxidase-Dependent Apoplastic Oxidative Burst in Cultured Arabidopsis Cells Functions in MAMP-Elicited Defense. *Jose A. O'Brien, Arsalan Daudi, Paul Finch, Vernon S. Butt, Julian P. Whitelegge, Puneet Souda, Frederick M. Ausubel, and G. Paul Bolwell* 2013–2027
- ^{[W][OA]}Loss of Function of *FATTY ACID DESATURASE7* in Tomato Enhances Basal Aphid Resistance in a Salicylate-Dependent Manner. *Carlos A. Avila, Lirio M. Arévalo-Soliz, Lingling Jia, Duroy A. Navarre, Zhaorigetu Chen, Gregg A. Howe, Qing-Wei Meng, Jonathon E. Smith, and Fiona L. Goggin* 2028–2041
- ^{[C][W][OA]}Low Red/Far-Red Ratios Reduce Arabidopsis Resistance to *Botrytis cinerea* and Jasmonate Responses via a *COI1-JAZ10*-Dependent, Salicylic Acid-Independent Mechanism. *Ignacio Cerrudo, Mercedes M. Keller, Miriam D. Cargnel, Patricia V. Demkura, Mieke de Wit, Micaela S. Patitucci, Ronald Pierik, Corné M.J. Pieterse, and Carlos L. Ballaré* 2042–2052

WHOLE PLANT AND ECOPHYSIOLOGY

- ^[OA]The Origin and Composition of Cucurbit “Phloem” Exudate. *Cankui Zhang, Xiyun Yu, Brian G. Ayre, and Robert Turgeon* 1873–1882
- ^{[C][W]}Release of Apical Dominance in Potato Tuber Is Accompanied by Programmed Cell Death in the Apical Bud Meristem. *Paula Teper-Bammolker, Yossi Buskila, Yael Lopesco, Shifra Ben-Dor, Inbal Saad, Vered Holdengreber, Eduard Belausov, Hanita Zemach, Naomi Ori, Amnon Lers, and Dani Eshel* 2053–2067

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- ^{[W][OA]}Expression of an Entire Bacterial Operon in Plants. *Rita Mozes-Koch, Ofer Gover, Edna Tanne, Yuval Peretz, Eyal Maori, Leonid Chernin, and Ilan Sela* 1883–1892

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