



**Cover image:** Pictured is a 3D superresolution image of fluorescently labeled actin filaments strung between silica support beads assembled in vitro. Andrew T. Lombardo et al. used a similar setup to investigate the transport of lipid-bound cargos by myosin Va molecular motors along 3D actin networks. The authors varied the polarity, position, and density of the actin filaments within the networks to reflect the kinds of networks the motors encounter within living cells. The results reveal how actin position and polarity determine the mode of cargo transport and suggest how cells regulate intracellular transport processes. See the article by Lombardo et al. on pages 8326–8335. Image courtesy of Andrew T. Lombardo and David M. Warshaw.

## From the Cover

- 8326 Actin cytoskeleton and intracellular transport
- 8190 Immediate aftermath of Chicxulub impact
- 8255 Racial bias and school discipline
- 8576 Engram neurons and memory consolidation
- 8609 Factors affecting monarch butterfly populations

## Contents

### THIS WEEK IN PNAS

- 8083 In This Issue

### EDITORIAL

- 8086 Speaking of gender bias  
*May R. Berenbaum*

### OPINION—Leading scientists discuss current issues

- 8089 Toward an international definition of citizen science  
*Florian Heigl, Barbara Kieslinger, Katharina T. Paul, Julia Uhlík, and Daniel Dörler*

### COMMENTARIES

- 8093 Advances in understanding the long-term population decline of monarch butterflies  
*Anurag A. Agrawal*  
→ See companion articles on page 8609, and on page 3006 in issue 8 of volume 116
- 8096 Radiocarbon dating the end of urban services in a late Roman town  
*Michael McCormick*  
→ See companion article on page 8239
- 8099 Shedding light into memories under circadian rhythm system control  
*Laura Teodori and Maria Cristina Albertini*  
→ See companion article on page 8576

### LETTERS

- 8102 Rainfall recycling needs to be considered in defining limits to the world's green water resources  
 *Meine van Noordwijk and David Ellison*
- 8104 Reply to van Noordwijk and Ellison: Moisture recycling: Key to assess hydrological impacts of land cover changes, but not to quantify water allocation to competing demands  
*Joep F. Schyns, Arjen Y. Hoekstra, Rick J. Hogeboom, and Martijn J. Booij*
- 8105 Demography and destiny: The syngameon in hyperdiverse systems  
*Charles H. Cannon and Manuel T. Lerdau*

- 8106 **Reply to Cannon and Lerdau: Maintenance of tropical forest tree diversity**

*Taal Levi, Michael Barfield, Robert D. Holt, and John Terborgh*

## INAUGURAL ARTICLE

- 8107 **Bootstrapping variables in algebraic circuits**  
*Manindra Agrawal, Sumanta Ghosh, and Nitin Saxena*

## PHYSICAL SCIENCES

### APPLIED PHYSICAL SCIENCES

- 8119 **Rigidity percolation and geometric information in floppy origami**  
*Siheng Chen and L. Mahadevan*

### BIOPHYSICS AND COMPUTATIONAL BIOLOGY

- 8125 **Measuring the average shape of transition paths during the folding of a single biological molecule**  
*Noel Q. Hoffer, Krishna Neupane, Andrew G. T. Pyo, and Michael T. Woodside*
- 8131 **Structural basis for ligand modulation of the CCR2 conformational landscape**  
*Bryn C. Taylor, Christopher T. Lee, and Rommie E. Amaro*
- 8137 **Ultrafast folding kinetics of WW domains reveal how the amino acid sequence determines the speed limit to protein folding**  
*Malwina Szczepaniak, Manuel Iglesias-Bexiga, Michele Cerminara, Mourad Sadqi, Celia Sanchez de Medina, Jose C. Martinez, Irene Luque, and Victor Muñoz*
- 8143 **Relative interfacial cleavage energetics of protein complexes revealed by surface collisions**  
*Sophie R. Harvey, Justin T. Seffernick, Royston S. Quintyn, Yang Song, Yue Ju, Jing Yan, Aniruddha N. Sahasrabudhe, Andrew Norris, Mowei Zhou, Edward J. Behrman, Steffen Lindert, and Vicki H. Wysocki*
- 8149 **Synergy of topoisomerase and structural-maintenance-of-chromosomes proteins creates a universal pathway to simplify genome topology**  
*Enzo Orlandini, Davide Marenduzzo, and Davide Michieletto*
- 8283 **Structural insights into unique features of the human mitochondrial ribosome recycling**  
*Ravi K. Koripella, Manjuli R. Sharma, Paul Risteff, Pooja Keshavan, and Rajendra K. Agrawal*
- 8320 **pH dependence, kinetics and light-harvesting regulation of nonphotochemical quenching in *Chlamydomonas***  
*Lijin Tian, Wojciech J. Nawrocki, Xin Liu, Iryna Polukhina, Ivo H. M. van Stokkum, and Roberta Croce*
- 8326 **Myosin Va transport of liposomes in three-dimensional actin networks is modulated by actin filament density, position, and polarity**  
*Andrew T. Lombardo, Shane R. Nelson, Guy G. Kennedy, Kathleen M. Trybus, Sam Walcott, and David M. Warshaw*

### CHEMISTRY

- 8155 **TePhe, a tellurium-containing phenylalanine mimic, allows monitoring of protein synthesis in vivo with mass cytometry**  
*Jay Bassan, Lisa M. Willis, Ravi N. Vellanki, Alan Nguyen, Landon J. Edgar, Brady G. Wouters, and Mark Nitz*

- 8161 **Light-heat conversion dynamics in highly diversified water-dispersed hydrophobic nanocrystal assemblies**  
*Andrea Mazzanti, Zhijie Yang, Mychel G. Silva, Nailiang Yang, Giancarlo Rizza, Pierre-Eugène Coulon, Cristian Manzoni, Ana Maria de Paula, Giulio Cerullo, Giuseppe Della Valle, and Marie-Paule Pileni*

- 8167 **Rational design of an argon-binding superelectrophilic anion**  
*Martin Mayer, Valentin van Lessen, Markus Rohdenburg, Gao-Lei Hou, Zheng Yang, Rüdiger M. Exner, Edoardo Aprà, Vladimir A. Azov, Simon Grabowsky, Sotiris S. Xantheas, Knut R. Asmis, Xue-Bin Wang, Carsten Jenne, and Jonas Warneke*

- 8173 **Imaging the Renner-Teller effect using laser-induced electron diffraction**  
*Kasra Amini, Michele Sclafani, Tobias Steinle, Anh-Thu Le, Aurelien Sanchez, Carolin Müller, Johannes Steinmetzer, Lun Yue, José Ramón Martínez Saavedra, Michaél Hemmer, Maciej Lewenstein, Robert Moshhammer, Thomas Pfeifer, Michael G. Pullen, Joachim Ullrich, Benjamin Wolter, Robert Moszynski, F. Javier García de Abajo, C. D. Lin, Stefanie Gräfe, and Jens Biegert*

- 8178 **Quintet-triplet mixing determines the fate of the multiexciton state produced by singlet fission in a terrylenediimide dimer at room temperature**  
*Michelle Chen, Matthew D. Krzyaniak, Jordan N. Nelson, Youn Jue Bae, Samantha M. Harvey, Richard D. Schaller, Ryan M. Young, and Michael R. Wasielewski*

### EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

- 8184 **Pore condensation and freezing is responsible for ice formation below water saturation for porous particles**  
*Robert O. David, Claudia Marcolli, Jonas Fahrni, Yuqing Qiu, Yamila A. Perez Sirkin, Valeria Molinero, Fabian Mahrt, Dominik Brühwiler, Ulrike Lohmann, and Zamin A. Kanji*
- 8190 **A seismically induced onshore surge deposit at the KPg boundary, North Dakota**  
*Robert A. DePalma, Jan Smit, David A. Burnham, Klaudia Kuiper, Phillip L. Manning, Anton Oleinik, Peter Larson, Florentin J. Maurrasse, Johan Vellekoop, Mark A. Richards, Loren Gurche, and Walter Alvarez*

### ENGINEERING

- 8200 **Propagation of pop ups in kirigami shells**  
*Ahmad Rafsanjani, Lishuai Jin, Bolei Deng, and Katia Bertoldi*
- 8554 **Fast and robust active neuron segmentation in two-photon calcium imaging using spatiotemporal deep learning**  
*Somayyeh Soltanian-Zadeh, Kaan Sahingur, Sarah Blau, Yiyang Gong, and Sina Farsiu*

### ENVIRONMENTAL SCIENCES

- 8206 **Gasification of coal and biomass as a net carbon-negative power source for environment-friendly electricity generation in China**  
*Xi Lu, Liang Cao, Haikun Wang, Wei Peng, Jia Xing, Shuxiao Wang, Siyi Cai, Bo Shen, Qing Yang, Chris P. Nielsen, and Michael B. McElroy*
- 8214 **Systems thinking as a pathway to global warming beliefs and attitudes through an ecological worldview**  
*Matthew T. Ballew, Matthew H. Goldberg, Seth A. Rosenthal, Abel Gustafson, and Anthony Leiserowitz*

- MATHEMATICS**
- 8107 **Bootstrapping variables in algebraic circuits**  
Manindra Agrawal, Sumanta Ghosh, and Nitin Saxena

- PHYSICS**
- 8220 **Superhydrophobic frictions**  
Timothée Mouterde, Pascal S. Raux, Christophe Clanet, and David Quéré

- 8224 **Molecular design of self-coacervation phenomena in block polyampholytes**  
Scott P. O. Danielsen, James McCarty, Joan-Emma Shea, Kris T. Delaney, and Glenn H. Fredrickson

- SUSTAINABILITY SCIENCE**
- 8249 **Effect of deforestation on access to clean drinking water**  
Annie Mwayi Mapulanga and Hisahiro Naito

## SOCIAL SCIENCES

- ANTHROPOLOGY**
- 8233 **Underwater ritual offerings in the Island of the Sun and the formation of the Tiwanaku state**  
Christophe Delaere, José M. Capriles, and Charles Stanish

- 8239 **Ancient trash mounds unravel urban collapse a century before the end of Byzantine hegemony in the southern Levant**  
Guy Bar-Oz, Lior Weissbrod, Tali Erickson-Gini, Yotam Tepper, Dan Malkinson, Mordechai Benzaquen, Dafna Langgut, Zachary C. Dunseth, Don H. Butler, Ruth Shahack-Gross, Joel Roskin, Daniel Fuks, Ehud Weiss, Nimrod Marom, Inbar Ktalav, Rachel Blevis, Irit Zohar, Yoav Farhi, Anya Filatova, Yael Gorin-Rosen, Xin Yan, and Elisabetta Boaretto  
→ See Commentary on page 8096

- ENVIRONMENTAL SCIENCES**
- 8249 **Effect of deforestation on access to clean drinking water**  
Annie Mwayi Mapulanga and Hisahiro Naito

- PSYCHOLOGICAL AND COGNITIVE SCIENCES**
- 8255 **Racial disparities in school-based disciplinary actions are associated with county-level rates of racial bias**  
Travis Riddle and Stacey Sinclair

- 8261 **The criminogenic and psychological effects of police stops on adolescent black and Latino boys**  
Juan Del Toro, Tracey Lloyd, Kim S. Buchanan, Summer Joi Robins, Lucy Zhang Bencharit, Meredith Gamson Smiedt, Kavita S. Reddy, Enrique Rodriguez Pouget, Erin M. Kerrison, and Phillip Atiba Goff

- 8564 **Biased competition in the absence of input bias revealed through corticostriatal computation**  
Salva Ardid, Jason S. Sherfey, Michelle M. McCarthy, Joachim Hass, Benjamin R. Pittman-Polletta, and Nancy Kopell

- 8570 **Locus coeruleus toggles reciprocal prefrontal firing to reinstate fear**  
Thomas F. Giustino, Paul J. Fitzgerald, Reed L. Ressler, and Stephen Maren

- SUSTAINABILITY SCIENCE**
- 8206 **Gasification of coal and biomass as a net carbon-negative power source for environment-friendly electricity generation in China**  
Xi Lu, Liang Cao, Haikun Wang, Wei Peng, Jia Xing, Shuxiao Wang, Siyi Cai, Bo Shen, Qing Yang, Chris P. Nielsen, and Michael B. McElroy

- 8425 **Multicentury perspective assessing the sustainability of the historical harvest of seaducks**  
Kathryn E. Hargan, H. Grant Gilchrist, Nikolas M. T. Clyde, Samuel A. Iverson, Mark R. Forbes, Linda E. Kimpe, Mark L. Mallory, Neal Michelutti, John P. Smol, and Jules M. Blais

## BIOLOGICAL SCIENCES

- APPLIED BIOLOGICAL SCIENCES**
- 8269 **Complete biosynthetic pathways of ascofuranone and ascochlorin in *Acremonium egyptiacum***  
Yasuko Araki, Takayoshi Awakawa, Motomichi Matsuzaki, Rihe Cho, Yudai Matsuda, Shotaro Hoshino, Yasutomo Shinohara, Masaichi Yamamoto, Yasutoshi Kido, Daniel Ken Inaoka, Kisaburo Nagamune, Kotaro Ito, Ikuro Abe, and Kiyoshi Kita

- 8275 **Daisy-chain gene drives for the alteration of local populations**  
Charleston Noble, John Min, Jason Olejarz, Joanna Buchthal, Alejandro Chavez, Andrea L. Smidler, Erika A. DeBenedictis, George M. Church, Martin A. Nowak, and Kevin M. Esvelt

- BIOCHEMISTRY**
- 8155 **TePhe, a tellurium-containing phenylalanine mimic, allows monitoring of protein synthesis in vivo with mass cytometry**  
Jay Bassan, Lisa M. Willis, Ravi N. Vellanki, Alan Nguyen, Landon J. Edgar, Bradley G. Wouters, and Mark Nitz

- 8283 **Structural insights into unique features of the human mitochondrial ribosome recycling**  
Ravi K. Koripella, Manjuli R. Sharma, Paul Risteff, Pooja Keshavan, and Rajendra K. Agrawal

- 8289 **Mechanism mediated by a noncoding RNA, nc886, in the cytotoxicity of a DNA-reactive compound**  
Nawapol Kunkeaw, Yeon-Su Lee, Wonkyun Ronny Im, Jiyoung Joan Jang, Min-Ji Song, Bobae Yang, Jong-Lyul Park, Seon-Young Kim, Yongsuk Ku, Yoosik Kim, Sangmin Kang, Hye-ram Jo, Jae-Hoon Jeong, Hyun-Sung Lee, Ju-Seog Lee, Hyoung-Pyo Kim, Betty H. Johnson, In-Hoo Kim, and Yong Sun Lee

- 8295 **Histone H3 tail binds a unique sensing pocket in EZH2 to activate the PRC2 methyltransferase**  
Krupa S. Jani, Siddhant U. Jain, Eva J. Ge, Katharine L. Diehl, Stefan M. Lundgren, Manuel M. Müller, Peter W. Lewis, and Tom W. Muir

- 8301 **Rational conversion of chromophore selectivity of cyanobacteriochromes to accept mammalian intrinsic biliverdin**  
Keiji Fushimi, Takatsugu Miyazaki, Yuto Kuwasaki, Takahiro Nakajima, Tatsuro Yamamoto, Kazushi Suzuki, Yoshibumi Ueda, Keita Miyake, Yuka Takeda, Jae-Hoon Choi, Hirokazu Kawagishi, Enoch Y. Park, Masahiko Ikeuchi, Moritoshi Sato, and Rei Narikawa

- 8310 **Genome-wide effects on *Escherichia coli* transcription from ppGpp binding to its two sites on RNA polymerase**  
Patricia Sanchez-Vazquez, Colin N. Dewey, Nicole Kitten, Wilma Ross, and Richard L. Gourse

- BIOPHYSICS AND COMPUTATIONAL BIOLOGY**
- 8125 **Measuring the average shape of transition paths during the folding of a single biological molecule**  
Noel Q. Hoffer, Krishna Neupane, Andrew G. T. Pyo, and Michael T. Woodside
- 8131 **Structural basis for ligand modulation of the CCR2 conformational landscape**  
Bryn C. Taylor, Christopher T. Lee, and Rommie E. Amaro

**8137** Ultrafast folding kinetics of WW domains reveal how the amino acid sequence determines the speed limit to protein folding  
*Malwina Szczepaniak, Manuel Iglesias-Bexiga, Michele Cerminara, Mourad Sadqi, Celia Sanchez de Medina, Jose C. Martinez, Irene Luque, and Victor Muñoz*

**8320** pH dependence, kinetics and light-harvesting regulation of nonphotochemical quenching in *Chlamydomonas*

*Lijin Tian, Wojciech J. Nawrocki, Xin Liu, Iryna Polukhina, Ivo H. M. van Stokkum, and Roberta Croce*

**8326** Myosin Va transport of liposomes in three-dimensional actin networks is modulated by actin filament density, position, and polarity

*Andrew T. Lombardo, Shane R. Nelson, Guy G. Kennedy, Kathleen M. Trybus, Sam Walcott, and David M. Warshaw*

**8336** Blind tests of RNA–protein binding affinity prediction

*Kalli Kappel, Inga Jarmoskaite, Pavanapuresan P. Vaidyanathan, William J. Greenleaf, Daniel Herschlag, and Rhiju Das*

**8342** Photocycle-dependent conformational changes in the proteorhodopsin cross-protomer Asp–His–Trp triad revealed by DNP-enhanced MAS-NMR

*Jakob Maciejko, Jagdeep Kaur, Johanna Becker-Baldus, and Clemens Glaubitz*

**8350** Extreme mechanical diversity of human telomeric DNA revealed by fluorescence-force spectroscopy

*Jaba Mitra, Monika A. Makurath, Thuy T. M. Ngo, Alice Troitskaia, Yann R. Chemla, and Taekjip Ha*

**8360** Stabilization of amyloidogenic immunoglobulin light chains by small molecules

*Gareth J. Morgan, Nicholas L. Yan, David E. Mortenson, Enrico Rennella, Joshua M. Blundon, Ryan M. Gwin, Chung-Yon Lin, Robyn L. Stanfield, Steven J. Brown, Hugh Rosen, Timothy P. Spicer, Virmeliz Fernandez-Vega, Giampaolo Merlini, Lewis E. Kay, Ian A. Wilson, and Jeffery W. Kelly*

**8370** Structural basis for auxiliary subunit KCTD16 regulation of the GABA<sub>B</sub> receptor

*Hao Zuo, Ian Glaaser, Yulin Zhao, Igor Kurinov, Lidia Mosyuk, Haonan Wang, Jonathan Liu, Jinseo Park, Aurel Frangaj, Emmanuel Sturchler, Ming Zhou, Patricia McDonald, Yong Geng, Paul A. Slesinger, and Qing R. Fan*

#### CELL BIOLOGY

**8380** Oncogenic *PIK3CA* promotes cellular stemness in an allele dose-dependent manner

*Ralitsa R. Madsen, Rachel G. Knox, Wayne Pearce, Saioa Lopez, Betania Mahler-Araujo, Nicholas McGranahan, Bart Vanhaesebroeck, and Robert K. Semple*

**8390** Mechanistic basis for impaired ferroptosis in cells expressing the African-centric S47 variant of p53

*Julia I-Ju Leu, Maureen E. Murphy, and Donna L. George*

#### DEVELOPMENTAL BIOLOGY

**8397** CAP2 deficiency delays myofibril actin cytoskeleton differentiation and disturbs skeletal muscle architecture and function

*Lara-Jane Kepser, Fidan Damar, Teresa De Cicco, Christine Chaponnier, Tomasz J. Prószyński, Axel Pagenstecher, and Marco B. Rust*

**8403** Untangling posterior growth and segmentation by analyzing mechanisms of axis elongation in hemichordates

*Jens H. Fritzenwanker, Kevin R. Uhlinger, John Gerhart, Elena Silva, and Christopher J. Lowe*

**8409** Prostaglandin signaling regulates renal multiciliated cell specification and maturation

*Amanda N. Marra, Basma D. Adeeb, Brooke E. Chambers, Bridgette E. Drummond, Marisa Ulrich, Amanda Addiego, Meghan Springer, Shahram J. Poureetezadi, Joseph M. Chambers, Matthew Ronshaugen, and Rebecca A. Wingert*

#### ECOLOGY

**8419** Phylogenetic, functional, and taxonomic richness have both positive and negative effects on ecosystem multifunctionality

*Yoann Le Bagousse-Pinguet, Santiago Soliveres, Nicolas Gross, Rubén Torices, Miguel Berdugo, and Fernando T. Maestre*

#### ENVIRONMENTAL SCIENCES

**8425** Multicentury perspective assessing the sustainability of the historical harvest of seaducks

*Kathryn E. Hargan, H. Grant Gilchrist, Nikolas M. T. Clyde, Samuel A. Iverson, Mark R. Forbes, Linda E. Kimpe, Mark L. Mallory, Neal Michelutti, John P. Smol, and Jules M. Blais*

#### EVOLUTION

**8431** Genomic evidence of survival near ice sheet margins for some, but not all, North American trees

*Jordan B. Bemmels, L. Lacey Knowles, and Christopher W. Dick*

**8437** Sexual conflict drives male manipulation of female postmating responses in *Drosophila melanogaster*

*Brian Hollis, Mareike Koppik, Kristina U. Wensing, Hanna Ruhmann, Eléonore Genzoni, Berra Erkosar, Tadeusz J. Kawecki, Claudia Fricke, and Laurent Keller*

#### GENETICS

**8445** Prediction and identification of recurrent genomic rearrangements that generate chimeric chromosomes in *Saccharomyces cerevisiae*

*Kim Palacios-Flores, Alejandra Castillo, Carina Uribe, Jair García Sotelo, Margareta Boege, Guillermo Dávila, Margarita Flores, Rafael Palacios, and Lucia Morales*

**8451** Differential expression of human tRNA genes drives the abundance of tRNA-derived fragments

*Adrian Gabriel Torres, Oscar Reina, Camille Stephan-Otto Attolini, and Lluís Ribas de Pouplana*

#### MEDICAL SCIENCES

**8457** VSMC-specific EP4 deletion exacerbates angiotensin II-induced aortic dissection by increasing vascular inflammation and blood pressure

*Hu Xu, Shengnan Du, Bingying Fang, Chaojie Li, Xiao Jia, Senfeng Zheng, Sailun Wang, Qingwei Li, Wen Su, Nanping Wang, Feng Zheng, Lihong Chen, Xiaoyan Zhang, Jan-Åke Gustafsson, and Youfei Guan*

**8463** Immune tolerance in multiple sclerosis and neuromyelitis optica with peptide-loaded tolerogenic dendritic cells in a phase 1b trial

*Irati Zubizarreta, Georgina Flórez-Grau, Gemma Vila, Raquel Cabezón, Carolina España, Magi Andorra, Albert Saiz, Sara Llufríu, Maria Sepulveda, Nuria Sola-Valls, Elena H. Martinez-Lapiscina, Irene Pulido-Valdeolivas, Bonaventura Casanova, Marisa Martinez Gines, Nieves Tellez, Celia Oreja-Guevara, Marta Español, Esteve Trias, Joan Cid, Manel Juan, Miquel Lozano, Yolanda Blanco, Lawrence Steinman, Daniel Benitez-Ribas, and Pablo Villoslada*



- 8471** **Conserved serum protein biomarkers associated with growing early colorectal adenomas**  
Melanie M. Ivancic, Leigh W. Anson, Perry J. Pickhardt, Bryant Megna, Bryan D. Pooler, Linda Clipson, Mark Reichelderfer, Michael R. Sussman, and William F. Dove
- MICROBIOLOGY**
- 8481** **Inhibitors of the *Neisseria meningitidis* PilF ATPase provoke type IV pilus disassembly**  
Flore Aubey, Jean-Philippe Corre, Youxin Kong, Ximing Xu, Dorian Obino, Sylvie Goussard, Catherine Lapeyrere, Judith Souphron, Cedric Couturier, Stéphane Renard, and Guillaume Duménil
- 8487** **Epidermal growth factor receptor is a host-entry cofactor triggering hepatitis B virus internalization**  
Masashi Iwamoto, Wakana Saso, Ryuichi Sugiyama, Koji Ishii, Mio Ohki, Shushi Nagamori, Ryosuke Suzuki, Hideki Aizaki, Akihide Ryo, Ji-Hye Yun, Sam-Yong Park, Naoko Ohtani, Masamichi Muramatsu, Shingo Iwami, Yasuhito Tanaka, Camille Sureau, Takaji Wakita, and Koichi Watashi
- 8493** **Regenerative therapy based on miRNA-302 mimics for enhancing host recovery from pneumonia caused by *Streptococcus pneumoniae***  
Yan Wang, Yong Li, Peggy Zhang, Sandy T. Baker, Marla R. Wolfson, Jeffrey N. Weiser, Ying Tian, and Hao Shen
- 8499** ***Klebsiella* and *Providencia* emerge as lone survivors following long-term starvation of oral microbiota**  
Jonathon L. Baker, Erik L. Hendrickson, Xiaoyu Tang, Renate Lux, Xuesong He, Anna Edlund, Jeffrey S. McLean, and Wenyuan Shi
- 8505** **Chemosynthetic symbiont with a drastically reduced genome serves as primary energy storage in the marine flatworm *Paracatenula***  
Oliver Jäckle, Brandon K. B. Seah, Målin Tietjen, Nikolaus Leisch, Manuel Liebecke, Manuel Kleiner, Jasmine S. Berg, and Harald R. Gruber-Vodicka
- 8515** **Widespread soil bacterium that oxidizes atmospheric methane**  
Alexander T. Tveit, Anne Grethe Hestnes, Serina L. Robinson, Arno Schintlmeister, Svetlana N. Dedysh, Nico Jehmlich, Martin von Bergen, Craig Herbold, Michael Wagner, Andreas Richter, and Mette M. Svenning
- 8525** **Biosynthesis and secretion of the microbial sulfated peptide RaxX and binding to the rice XA21 immune receptor**  
Dee Dee Luu, Anna Joe, Yan Chen, Katarzyna Parys, Ofir Bahar, Rory Pruitt, Leanne Jade G. Chan, Christopher J. Petzold, Kelsey Long, Clifford Adamchak, Valley Stewart, Youssef Belkhadir, and Pamela C. Ronald
- 8535** **Ebolavirus polymerase uses an unconventional genome replication mechanism**  
Laure R. Deflubé, Tessa N. Cressey, Adam J. Hume, Judith Olejnik, Elaine Haddock, Friederike Feldmann, Hideki Ebihara, Rachel Fearns, and Elke Mühlberger
- 8544** ***Streptococcus gordonii* programs epithelial cells to resist ZEB2 induction by *Porphyromonas gingivalis***  
Jun Ohshima, Qian Wang, Zackary R. Fitzsimonds, Daniel P. Miller, Maryta N. Sztukowska, Young-Jung Jung, Mikako Hayashi, Marvin Whiteley, and Richard J. Lamont
- NEUROSCIENCE**
- 8554** **Fast and robust active neuron segmentation in two-photon calcium imaging using spatiotemporal deep learning**  
Somayyeh Soltanian-Zadeh, Kaan Sahingur, Sarah Blau, Yiyang Gong, and Sina Farsiu
- 8564** **Biased competition in the absence of input bias revealed through corticostriatal computation**  
Salva Ardid, Jason S. Sherfey, Michelle M. McCarthy, Joachim Hass, Benjamin R. Pittman-Polletta, and Nancy Kopell
- 8570** **Locus coeruleus toggles reciprocal prefrontal firing to reinstate fear**  
Thomas F. Giustino, Paul J. Fitzgerald, Reed L. Ressler, and Stephen Maren
- 8576** **Optogenetic reactivation of memory ensembles in the retrosplenial cortex induces systems consolidation**  
André F. de Sousa, Kiriana K. Cowansage, Ipshita Zutshi, Leonardo M. Cardozo, Eun J. Yoo, Stefan Leutgeb, and Mark Mayford  
→ See Commentary on page 8099
- 8582** **Childhood trauma history is linked to abnormal brain connectivity in major depression**  
Meichen Yu, Kristin A. Linn, Russell T. Shinohara, Desmond J. Oathes, Philip A. Cook, Romain Duprat, Tyler M. Moore, Maria A. Oquendo, Mary L. Phillips, Melvin McInnis, Maurizio Fava, Madhukar H. Trivedi, Patrick McGrath, Ramin Parsey, Myrna M. Weissman, and Yvette I. Sheline
- PHYSIOLOGY**
- 8591** **Large-conductance Ca<sup>2+</sup>- and voltage-gated K<sup>+</sup> channels form and break interactions with membrane lipids during each gating cycle**  
Yutao Tian, Stefan H. Heinemann, and Toshinori Hoshi
- PLANT BIOLOGY**
- 8597** **EXPANSIN A1-mediated radial swelling of pericycle cells positions anticlinal cell divisions during lateral root initiation**  
Priya Ramakrishna, Paola Ruiz Duarte, Graham A. Rance, Martin Schubert, Vera Vordermaier, Lam Dai Vu, Evan Murphy, Amaya Vilches Barro, Kamal Swarup, Kamaljit Moirangthem, Bodil Jørgensen, Brigitte van de Cotte, Tatsuaki Goh, Zhefeng Lin, Ute Voß, Tom Beeckman, Malcolm J. Bennett, Kris Gevaert, Alexis Maizel, and Ive De Smet
- 8603** **PCH1 regulates light, temperature, and circadian signaling as a structural component of phytochrome B-photobodies in *Arabidopsis***  
He Huang, Katrice E. McLoughlin, Maria L. Sorkin, E. Seth Burgie, Rebecca K. Bindbeutel, Richard D. Vierstra, and Dmitri A. Nusinow
- POPULATION BIOLOGY**
- 8609** **Multiscale seasonal factors drive the size of winter monarch colonies**  
Sarah P. Saunders, Leslie Ries, Naresh Neupane, M. Isabel Ramírez, Eligio García-Serrano, Eduardo Rendón-Salinas, and Elise F. Zipkin  
→ See Commentary on page 8093
- PSYCHOLOGICAL AND COGNITIVE SCIENCES**
- 8615** **Chronic psychosocial stress compromises the immune response and endochondral ossification during bone fracture healing via β-AR signaling**  
Melanie Haffner-Luntzer, Sandra Foertsch, Verena Fischer, Katja Prystaz, Miriam Tschaffon, Yvonne Mödinger, Chelsea S. Bahney, Ralph S. Marcucio, Theodore Miclau, Anita Ignatius, and Stefan O. Reber

## SUSTAINABILITY SCIENCE

- 8623  **Realizing the values of natural capital for inclusive, sustainable development: Informing China's new ecological development strategy**

Hua Zheng, Lijuan Wang, Wenjia Peng, Cuiping Zhang, Cong Li, Brian E. Robinson, Xiaochen Wu, Lingqiao Kong, Ruonan Li, Yi Xiao, Weihua Xu, Zhiyun Ouyang, and Gretchen C. Daily

## CORRECTIONS

## ENGINEERING

- 8629 **Light-triggered thermal conductivity switching in azobenzene polymers**  
Jungwoo Shin, Jaeuk Sung, Minjee Kang, Xu Xie, Byeongdu Lee, Kyung Min Lee, Timothy J. White, Cecilia Leal, Nancy R. Sottos, Paul V. Braun, and David G. Cahill

## GENETICS

- 8630 **Epigenetic mechanisms modulate differences in *Drosophila* foraging behavior**  
Ina Anreiter, Jamie M. Kramer, and Marla B. Sokolowski

## MEDICAL SCIENCES

- 8632 **A model of human phenylalanine metabolism in normal subjects and in phenylketonuric patients**  
Seymour Kaufman

## PLANT BIOLOGY

- 8633 **Maternal small RNAs mediate spatial-temporal regulation of gene expression, imprinting, and seed development in *Arabidopsis***  
Ryan C. Kirkbride, Jie Lu, Changqing Zhang, Rebecca A. Mosher, David C. Baulcombe, and Z. Jeffrey Chen