

Cover image: Micrograph of seven neurons in the rat neonatal neocortex, recorded and stained with a dye. These neurons connect and disconnect from each other spontaneously. When a stimulus is presented, each neuron tends to connect to many more neurons and then prunes weaker connections to settle down to a new circuit configuration. See the article by Le Bé and Markram on pages 13214–13219. Image courtesy of Jean-Vincent Le Bé and Henry Markram.

From the Cover

13214 Synaptic rewiring in neonatal cortex

12974 Properties of supercooled water

12981 Overdominant loci in tomato fitness

13156 Myeloid progenitors to vascular cells

13226 Ghrelin vaccine against weight gain

Contents

THIS WEEK IN PNAS

12953 In This Issue

COMMENTARIES

12955 **Breakdown of the Stokes–Einstein relation in supercooled water**

Pradeep Kumar

→ See companion article on page 12974

12957 **Unraveling the genetic basis of hybrid vigor**

James A. Birchler, Hong Yao,
and Sivanandan Chudalayandi

→ See companion article on page 12981

12959 **My O'Myeloid, a tale of two lineages**

Ann C. Zovein and M. Luisa Iruela-Arispe

→ See companion article on page 13156

12961 **In search of an effective obesity treatment:**

A shot in the dark or a shot in the arm?

Jeffrey M. Zigman and Joel K. Elmquist

→ See companion article on page 13226

PROFILE

12963 **Profile of Edward I. Solomon**

Nick Zagorski

→ See Inaugural Article on page 12966

INAUGURAL ARTICLE

12966 **Spectroscopic and electronic structure studies of aromatic electrophilic attack and hydrogen-atom abstraction by non-heme iron enzymes**

Michael L. Neidig, Andrea Decker, Oliver W. Choroba,
Fanglu Huang, Michael Kavana, Graham R. Moran,
Jonathan B. Spencer, and Edward I. Solomon

→ See Profile on page 12963

PHYSICAL SCIENCES

APPLIED PHYSICAL SCIENCES

12974 **The violation of the Stokes–Einstein relation in supercooled water**

Sow-Hsin Chen, Francesco Mallamace,
Chung-Yuan Mou, Matteo Broccio,
Carmelo Corsaro, Antonio Faraone,
and Li Liu

→ See Commentary on page 12955

12999 **Single-molecule mechanics of mussel adhesion**

Haeshin Lee, Norbert F. Scherer, and Phillip B. Messersmith

13051 **Swimming *Paramecium* in magnetically simulated enhanced, reduced, and inverted gravity environments**

Karine Guevorkian and James M. Valles, Jr.

 Freely available online through the PNAS open access option.

CHEMISTRY

- 12966 **Spectroscopic and electronic structure studies of aromatic electrophilic attack and hydrogen-atom abstraction by non-heme iron enzymes**
Michael L. Neidig, Andrea Decker, Oliver W. Choroba, Fanglu Huang, Michael Kavana, Graham R. Moran, Jonathan B. Spencer, and Edward I. Solomon
→ See Profile on page 12963
- 12979 **Amplification of enantiomeric concentrations under credible prebiotic conditions**
Ronald Breslow and Mindy S. Levine

ENVIRONMENTAL SCIENCES


- 13116 **A climate-change risk analysis for world ecosystems**
Marko Scholze, Wolfgang Knorr, Nigel W. Arnell, and I. Colin Prentice

PHYSICS

- 13121 **Scale-invariant structure of strongly conserved sequence in genomic intersections and alignments**
William Salerno, Paul Havlak, and Jonathan Miller

BIOLOGICAL SCIENCES


AGRICULTURAL SCIENCES

- 12981 **Overdominant quantitative trait loci for yield and fitness in tomato**
 Yaniv Semel, Jonathan Nissenbaum, Naama Menda, Michael Zinder, Uri Krieger, Noa Issman, Tzili Pleban, Zachary Lippman, Amit Gur, and Dani Zamir
→ See Commentary on page 12957
- 12987 **Overexpressing a NAM, ATAF, and CUC (NAC) transcription factor enhances drought resistance and salt tolerance in rice**
Honghong Hu, Mingqiu Dai, Jialing Yao, Benze Xiao, Xianghua Li, Qifa Zhang, and Lizhong Xiong


APPLIED BIOLOGICAL SCIENCES

- 12993 **Adeno-associated virus serotype 9 vectors transduce murine alveolar and nasal epithelia and can be readministered**
Maria P. Limberis and James M. Wilson

BIOCHEMISTRY


- 12999 **Single-molecule mechanics of mussel adhesion**
Haeshin Lee, Norbert F. Scherer, and Phillip B. Messersmith
- 13004 **Quantification of protein half-lives in the budding yeast proteome**
 Archana Belle, Amos Tanay, Ledion Bitincka, Ron Shamir, and Erin K. O'Shea
- 13010 **Molecular basis for the herbicide resistance of Roundup Ready crops**
Todd Funke, Huijong Han, Martha L. Healy-Fried, Markus Fischer, and Ernst Schönbrunn
- 13016 **Structure of archaeal translational initiation factor 2 $\beta\gamma$ -GDP reveals significant conformational change of the β -subunit and switch 1 region**
Masaaki Sokabe, Min Yao, Naoki Sakai, Shingo Toya, and Isao Tanaka

- 13022 **Stable stem cell commitment to the adipocyte lineage by inhibition of DNA methylation: Role of the BMP-4 gene**
Robert R. Bowers, Jae Woo Kim, Tamara C. Otto, and M. Daniel Lane


- 13028 **Structural basis for the inhibition of insulin-like growth factors by insulin-like growth factor-binding proteins**
 Tomasz Sitar, Grzegorz M. Popowicz, Igor Siwanowicz, Robert Huber, and Tad A. Holak

- 13034 **Kelch-repeat proteins interacting with the G_{α} protein Gpa2 bypass adenylate cyclase for direct regulation of protein kinase A in yeast**
Tom Peeters, Wendy Louwet, Ruud Geladé, David Nauwelaers, Johan M. Thevelein, and Matthias Versele

BIOPHYSICS

- 12966 **Spectroscopic and electronic structure studies of aromatic electrophilic attack and hydrogen-atom abstraction by non-heme iron enzymes**
Michael L. Neidig, Andrea Decker, Oliver W. Choroba, Fanglu Huang, Michael Kavana, Graham R. Moran, Jonathan B. Spencer, and Edward I. Solomon
→ See Profile on page 12963
- 13040 **Precise adaptation in bacterial chemotaxis through "assistance neighborhoods"**
Robert G. Endres and Ned S. Wingreen
- 13045 **Surface-modulated motion switch: Capture and release of iron-sulfur protein in the cytochrome bc_1 complex**
 Lothar Esser, Xing Gong, Shaoqing Yang, Linda Yu, Chang-An Yu, and Di Xia
- 13051 **Swimming *Paramecium* in magnetically simulated enhanced, reduced, and inverted gravity environments**
Karine Guevorkian and James M. Valles, Jr.
- 13057 **The role of hydrophobic interactions in initiation and propagation of protein folding**
H. Jane Dyson, Peter E. Wright, and Harold A. Scheraga
- 13062 **Regulation of outside-in signaling and affinity by the β_2 I domain of integrin $\alpha_1\beta_2$**
JianFeng Chen, Wei Yang, Minsoo Kim, Christopher V. Carman, and Timothy A. Springer

CELL BIOLOGY

- 13068 **Human cytomegalovirus-encoded chemokine receptor US28 promotes tumorigenesis**
David Maussang, Dennis Verzijl, Marijke van Walsum, Rob Leurs, Jens Holl, Olivier Pleskoff, Detlef Michel, Guus A. M. S. van Dongen, and Martine J. Smit
- 13074 **A repressor complex, AP4 transcription factor and geminin, negatively regulates expression of target genes in nonneuronal cells**
 Mi-Young Kim, Byung Chul Jeong, Ji Hee Lee, Hae Jin Kee, Hyun Kook, Nack Sung Kim, Yoon Ha Kim, Jong-Keun Kim, Kyu Youn Ahn, and Kyung Keun Kim
- 13080 **The last eukaryotic common ancestor (LECA): Acquisition of cytoskeletal motility from aerotolerant spirochetes in the Proterozoic Eon**
Lynn Margulis, Michael Chapman, Ricardo Guerrero, and John Hall

- 13086 **Dynamic redox control of NF- κ B through glutaredoxin-regulated S-glutathionylation of inhibitory κ B kinase β**
Niki L. Reynaert, Albert van der Vliet, Amy S. Guala, Toby McGovern, Milena Hristova, Cristen Pantano, Nicholas H. Heintz, John Heim, Ye-Shih Ho, Dwight E. Matthews, Emiel F. M. Wouters, and Yvonne M. W. Janssen-Heininger
- 13092 **Heat-shock transcription factor (HSF)-1 pathway required for *Caenorhabditis elegans* immunity**
Varsha Singh and Alejandro Aballay

DEVELOPMENTAL BIOLOGY

- 13098 **Spermatozoa and spermatids retrieved from frozen reproductive organs or frozen whole bodies of male mice can produce normal offspring**
Narumi Ogonuki, Keiji Mochida, Hiromi Miki, Kimiko Inoue, Martin Fray, Takamasa Iwaki, Kazuo Moriwaki, Yuichi Obata, Kazuto Morozumi, Ryuzo Yanagimachi, and Atsuo Ogura

ECOLOGY

- 13104 **Annually reoccurring bacterial communities are predictable from ocean conditions**
Jed A. Fuhrman, Ian Hewson, Michael S. Schwalbach, Joshua A. Steele, Mark V. Brown, and Shahid Naem

ENVIRONMENTAL SCIENCES

- 13110 **Plague dynamics are driven by climate variation**
Nils Chr. Stenseth, Noelle I. Samia, Hildegunn Viljugrein, Kyrre Linné Kausrud, Mike Begon, Stephen Davis, Herwig Leirs, V. M. Dubyanskiy, Jan Esper, Vladimir S. Ageyev, Nikolay L. Klassovskiy, Sergey B. Pole, and Kung-Sik Chan
- 13116 **A climate-change risk analysis for world ecosystems**
Marko Scholze, Wolfgang Knorr, Nigel W. Arnell, and I. Colin Prentice

EVOLUTION

- 13080 **The last eukaryotic common ancestor (LECA): Acquisition of cytoskeletal motility from aerotolerant spirochetes in the Proterozoic Eon**
Lynn Margulis, Michael Chapman, Ricardo Guerrero, and John Hall
- 13121 **Scale-invariant structure of strongly conserved sequence in genomic intersections and alignments**
William Salerno, Paul Havlak, and Jonathan Miller
- 13126 **The cyanobacterial genome core and the origin of photosynthesis**
Armen Y. Mulikdjanian, Eugene V. Koonin, Kira S. Makarova, Sergey L. Mekhedov, Alexander Sorokin, Yuri I. Wolf, Alexis Dufresne, Frédéric Partensky, Henry Burd, Denis Kaznadzey, Robert Haselkorn, and Michael Y. Galperin

IMMUNOLOGY

- 13132 **A2A adenosine receptor protects tumors from antitumor T cells**
Akio Ohta, Elieser Gorelik, Simon J. Prasad, Franca Ronchese, Dmitry Lukashov, Michael K. K. Wong, Xiaojun Huang, Sheila Caldwell, Kebin Liu, Patrick Smith, Jiang-Fan Chen, Edwin K. Jackson, Sergey Apasov, Scott Abrams, and Michail Sitkovsky

- 13138 **OX40 ligand shuts down IL-10-producing regulatory T cells**
Tomoki Ito, Yui-Hsi Wang, Omar Duramad, Shino Hanabuchi, Olivia A. Perng, Michel Gilliet, F. Xiao-Feng Qin, and Yong-Jun Liu

- 13144 **Direct stimulation of T lymphocytes by immunosomes: Virus-like particles decorated with T cell receptor/CD3 ligands plus costimulatory molecules**
Sophia V. Derdak, Hans J. Kueng, Victoria M. Leb, Alina Neunkirchner, Klaus G. Schmetterer, Edith Bielek, Otto Majdic, Walter Knapp, Brian Seed, and Winfried F. Pickl

MEDICAL SCIENCES

- 13150 **Coactosin-like protein supports 5-lipoxygenase enzyme activity and up-regulates leukotriene A₄ production**
Marija Rakonjac, Lutz Fischer, Patrick Provost, Oliver Werz, Dieter Steinhilber, Bengt Samuelsson, and Olof Rådmark

- 13156 **Myeloid lineage progenitors give rise to vascular endothelium**
Alexis S. Bailey, Holger Willenbring, Shuguang Jiang, Daniel A. Anderson, David A. Schroeder, Melissa H. Wong, Markus Grompe, and William H. Fleming
→ See Commentary on page 12959

- 13162 **Estrogen receptor (ER)- β isoforms: A key to understanding ER- β signaling**
Yuet-Kin Leung, Paul Mak, Sazzad Hassan, and Shuk-Mei Ho

- 13168 **Side population in adult murine epidermis exhibits phenotypic and functional characteristics of keratinocyte stem cells**
Richard P. Redvers, Amy Li, and Pritinder Kaur

- 13174 **Synergy between immune cells and adult neural stem/progenitor cells promotes functional recovery from spinal cord injury**
Yaniv Ziv, Hila Avidan, Stefano Pluchino, Gianvito Martino, and Michal Schwartz

- 13180 **Alveolar epithelial cell mesenchymal transition develops *in vivo* during pulmonary fibrosis and is regulated by the extracellular matrix**
Kevin K. Kim, Matthias C. Kugler, Paul J. Wolters, Liliane Robillard, Michael G. Galvez, Alexis N. Brumwell, Dean Sheppard, and Harold A. Chapman

MICROBIOLOGY

- 13186 **A proteomic study of *Methylobacterium extorquens* reveals a response regulator essential for epiphytic growth**
Benjamin Gourion, Michel Rossignol, and Julia A. Vorholt
- 13192 **Apicoplast fatty acid synthesis is essential for organelle biogenesis and parasite survival in *Toxoplasma gondii***
Jolly Mazumdar, Emma H. Wilson, Kate Masek, Christopher A. Hunter, and Boris Striepen

NEUROSCIENCE

- 13198 **Evidence for stroke-induced neurogenesis in the human brain**
Kunlin Jin, Xiaomei Wang, Lin Xie, Xiao Ou Mao, Wei Zhu, Yin Wang, Jianfeng Shen, Ying Mao, Surita Banwait, and David A. Greenberg

