

## EDITORIAL

- 513 The New Egypt  
*Bruce Alberts*

## NEWS OF THE WEEK

- 518 A roundup of the week's top stories

## NEWS & ANALYSIS

- 521 U.S. Spending Bill Limits Joint Efforts With China
- 522 Peering Back 13 Billion Years, Through a Gravitational Lens
- 523 Shortages of Cancer Drugs Put Patients, Trials at Risk
- 524 Faculties Wither as Higher Education System Rapidly Expands
- 525 'Breakthrough' Deal on Flu Strains the Modest Provisions

## NEWS FOCUS

- 526 Are Dolphins Too Smart for Captivity?  
*>> Science Podcast*
- 530 Using the Psychology of Evil to Do Good
- 533 Jeremy Berg: An Independent Scientist Departs NIH's Ranks
- 534 Paleoanthropology Society and American Association of Physical Anthropologists Meeting  
A New Ancestor for *Homo*?  
Ancient Footprints Tell Tales of Travel  
Snapshots From the Meeting

## LETTERS

- 536 Toxicologists Welcome Assessment Assistance  
*Society of Toxicology et al.*
- Peaceful Collaborations Deserve Support  
*W. Altermann*
- Prioritizing Taxonomists  
*S. K. Uniyal*

- 537 Life in Science: Ichthyologists Hooked on Facebook  
*B. Sidlauskas et al.*
- 537 TECHNICAL COMMENT ABSTRACTS
- 537 CORRECTIONS AND CLARIFICATIONS

## BOOKS ET AL.

- 538 SuperCooperators  
*M. A. Nowak, with R. Highfield, reviewed by D. Krakauer*
- 539 The Blame Game  
*C. Hood, reviewed by J. Brehm*

## POLICY FORUM

- 540 Ethical Framework for Biofuels  
*A. Buyx and J. Tait*

## PERSPECTIVES

- 542 Damping by Depletion  
*S. Sakaguchi and K. Wing >> Report p. 600*
- 543 Phase-Change Memories on a Diet  
*M. Salinga and M. Wuttig >> Report p. 568*
- 544 The Two Faces of SAM  
*J. Stubbe >> Report p. 604; Science Express Report by A. K. Boal et al.*
- 546 How Do You Want That Insulator?  
*G. A. Fiete >> Report p. 560*
- 547 Alternative Actions for Antibiotics  
*W. C. Ratcliff and R. F. Denison*
- 549 Retrospective: Thomas Eisner (1929–2011)  
*J. Meinwald et al.*

## SCIENCE PRIZE ESSAY

- 550 Science Buddies: Advancing Informal Science Education  
*K. L. Hess et al.*

CONTENTS continued >>

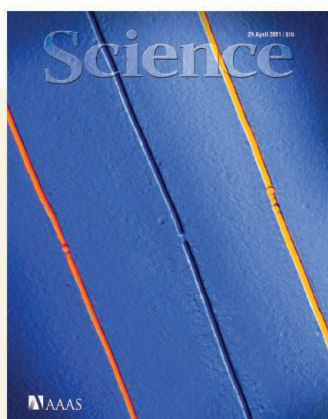


page 526



page 538

Downloaded from <http://science.sciencemag.org/> on January 18, 2018



## COVER

False-colored atomic force microscopy image of three carbon nanotubes on a silicon dioxide substrate (composite of scans on three devices). The middle nanotube is disconnected by a ~40-nanometer gap; the outer nanotubes have similar nanogaps bridged by a phase-change material (PCM) bit. Such small bits can be switched by voltage pulses with energy consumption that is one hundred times lower than that of modern PCM data storage. See page 568.

Image: Alex Jerez, Feng Xiong, and Eric Pop, University of Illinois Urbana-Champaign

## DEPARTMENTS

- 511 This Week in *Science*
- 514 Editors' Choice
- 516 *Science* Staff
- 552 AAAS News & Notes
- 612 New Products
- 613 *Science* Careers

## REVIEW

- 555 Microresonator-Based Optical Frequency Combs  
T. J. Kippenberg et al.

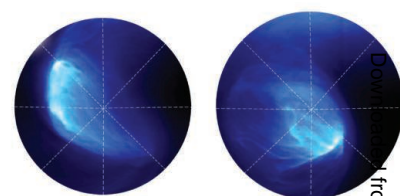
## REPORTS

- 560 Topological Phase Transition and Texture Inversion in a Tunable Topological Insulator  
S.-Y. Xu et al.  
Two types of bulk insulator are realized in the same family of compounds through chemical doping.  
>> *Perspective p. 546*
- 564 Orbital-Independent Superconducting Gaps in Iron Pnictides  
T. Shimajima et al.  
Bulk photoemission studies of iron pnictides suggest a role for orbital fluctuations in creating the superconducting state.
- 568 Low-Power Switching of Phase-Change Materials with Carbon Nanotube Electrodes  
F. Xiong et al.  
The crystallinity and resistivity of a compound semiconductor was changed with current pulses delivered by nanoelectrodes.  
>> *Perspective p. 543*
- 570 Low-Voltage, Low-Power, Organic Light-Emitting Transistors for Active Matrix Displays  
M. A. McCarthy et al.  
Efficient organic light-emitting transistors use carbon nanotubes as the source electrode.  
>> *Science Podcast*
- 574 Proton-Catalyzed, Silane-Fueled Friedel-Crafts Coupling of Fluoroarenes  
O. Allemann et al.  
Silicon-fluorine bond formation expands the range of compounds that can be used in a reaction that forms carbon-carbon bonds.
- 577 Venus's Southern Polar Vortex Reveals Precessing Circulation  
D. Luz et al.  
Observations with the Venus Express Orbiter reveal complex polar atmospheric dynamics.
- 580 Surface-Generated Mesoscale Eddies Transport Deep-Sea Products from Hydrothermal Vents  
D. K. Adams et al.  
Deep-reaching eddies transport heat and material hundreds of kilometers from the northern East Pacific Rise.

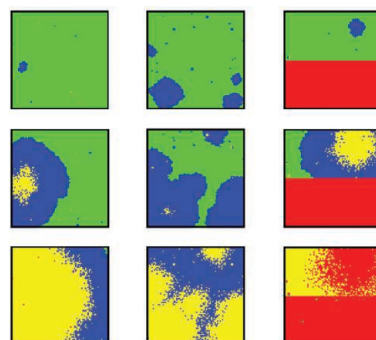
- 583 Brain Evolution Triggers Increased Diversification of Electric Fishes  
B. A. Carlson et al.  
Evolution of the perceptual abilities of mormyrid electric fishes increased signal variation and species diversification.
- 586 Self-Organizing and Stochastic Behaviors During the Regeneration of Hair Stem Cells  
M. V. Plikus et al.  
Cycling of active and quiescent states of the hair follicle integrates activator and inhibitor signals for patterning.
- 589 Conserved Eukaryotic Fusogens Can Fuse Viral Envelopes to Cells  
O. Avinoam et al.  
A *Caenorhabditis elegans* cell-surface fusion protein can promote viral fusion with mammalian cells.
- 592 The Spatial Periodicity of Grid Cells Is Not Sustained During Reduced Theta Oscillations  
J. Koenig et al.  
Grid cell firing vanished after medial septum inhibition, while most hippocampal place cell firing was retained.
- 595 Reduction of Theta Rhythm Dissociates Grid Cell Spatial Periodicity from Directional Tuning  
M. P. Brandon et al.  
Inhibition of neuronal activity in the medial septum stops grid cells in the medial entorhinal cortex from firing in a grid.
- 600 Trans-Endocytosis of CD80 and CD86: A Molecular Basis for the Cell-Extrinsic Function of CTLA-4  
O. S. Qureshi et al.  
An inhibitory T cell receptor acts by stripping activating ligands off dendritic cells.  
>> *Perspective p. 542*
- 604 A Radically Different Mechanism for S-Adenosylmethionine-Dependent Methyltransferases  
T. L. Grove et al.  
Methylation of the bacterial ribosome by two methyltransferases proceeds by an unusual radical mechanism.  
>> *Perspective p. 544; Science Express Report by A. K. Boal et al.*
- 608 A Crystal Structure of the Complex Between Human Complement Receptor 2 and Its Ligand C3d  
J. M. H. van den Elsen and D. E. Isenman  
The topology of this molecular interface provides a foundation for the design of therapeutics against autoreactive B cells.



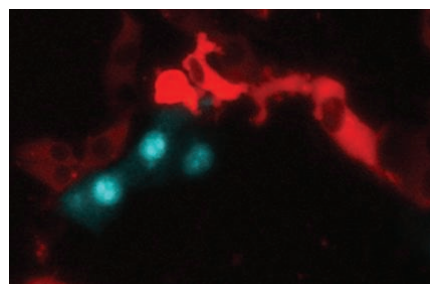
page 540



page 577



page 586



page 589

CONTENTS continued &gt;&gt;

## SCIENCEONLINE

## SCIENCEEXPRESS

[www.scienceexpress.org](http://www.scienceexpress.org)

### Structural Basis for Methyl Transfer by a Radical SAM Enzyme

A. K. Boal et al.

An enzyme harnesses methyl donation and reductive cleavage of its cofactor, within a single active site, to methylate RNA.

10.1126/science.1205358

>> *Perspective p. 544; Report p. 604*

### Human Cytomegalovirus Directly Induces the Antiviral Protein Viperin to Enhance Infectivity

J.-Y. Seo et al.

Human cytomegalovirus uses a host-encoded antiviral protein to its own advantage.

10.1126/science.1202007

### Early Warnings of Regime Shifts: A Whole-Ecosystem Experiment

S. R. Carpenter et al.

High-frequency monitoring of manipulated and reference lakes enabled early detection of subsequent catastrophic regime shift.

10.1126/science.1203672

### Spin-Liquid Ground State of the $S = 1/2$ Kagome Heisenberg Antiferromagnet

S. Yan et al.

Numerical calculations reveal that the true ground state of a frustrated two-dimensional system is a gapped spin liquid.

10.1126/science.1201080

### Imaging Doped Holes in a Cuprate Superconductor with High-Resolution Compton Scattering

Y. Sakurai et al.

Inelastic x-ray scattering probed the doping dependence of the electronic environment within a cuprate superconductor.

10.1126/science.1199391

### The 2010 $M_w$ 8.8 Maule Mega-Thrust Earthquake of Central Chile, Monitored by GPS

C. Vigny et al.

Rupture kinematics of this very large earthquake were obtained from high-resolution global positioning system data.

10.1126/science.1204132

### Corrections and Clarifications

Replication of "The Perception of Rational, Goal-Directed Action in Nonhuman Primates" by J. N. Wood and M. D. Hauser.

10.1126/science.1202596

## TECHNICALCOMMENTS

### Comment on "Erosion of Lizard Diversity by Climate Change and Altered Thermal Niches"

S. Clusella-Trullas and S. L. Chown

Full text at [www.sciencemag.org/cgi/content/full/332/6029/537-a](http://www.sciencemag.org/cgi/content/full/332/6029/537-a)

### Response to Comment on "Erosion of Lizard Diversity by Climate Change and Altered Thermal Niches"

B. Sinervo et al.

Full text at [www.sciencemag.org/cgi/content/full/332/6029/537-b](http://www.sciencemag.org/cgi/content/full/332/6029/537-b)

## SCIENCENOW

[www.sciencenow.org](http://www.sciencenow.org)

Highlights From Our Daily News Coverage

### Expert Panel: Central U.S. Faces

#### Real Threat of Quake

Millions in the American heartland face a genuine, if uncertain, seismic risk.

<http://scim.ag/new-madrid>

### 2010's Volcano-Induced Air Travel Shutdown Was Justified

Study finds that Eyjafjallajökull ash could have harmed aircraft.

<http://scim.ag/air-shutdown>

### Fire Ants Surf Floods on Rafts of Their Own Bodies

Thousands of ants link together to trap air and repel water.

<http://scim.ag/ant-rafts>

## SCIENCE SIGNALING

[www.sciencesignaling.org](http://www.sciencesignaling.org)

The Signal Transduction Knowledge Environment

26 April issue: <http://scim.ag/ss042611>

## EDITORIAL GUIDE: Focus Issue—

### Moving in the Right Direction

W. Wong

Various signaling pathways enable cells to sense environmental cues and direct their migration accordingly.

### RESEARCH ARTICLE: Thioredoxin Mediates Oxidation-Dependent Phosphorylation of CRMP2 and Growth Cone Collapse

A. Morinaka et al.

Repulsive guidance signaling triggers the collapse of neuronal growth cones through a mechanism involving oxidation and phosphorylation.

### PERSPECTIVE: PI3K and Chemotaxis—A Priming Issue?

P. V. Afonso and C. A. Parent

The differentiation status of cells may explain contradictory findings for the role of PI3K in chemotaxis.

### PERSPECTIVE: Sorting the Signals from the Signals in the Noisy Environment of Inflammation

W. A. Muller

Neutrophils follow specific cues to migrate through inflamed tissue into necrotic tissue.

### JOURNAL CLUB: Analyzing the Anatomy of Integrin Adhesions

A. Byron

The spatial organization of integrin adhesions provides insight into their molecular functions.

## SCIENCE CAREERS

[www.sciencereaders.org/career\\_magazine](http://www.sciencereaders.org/career_magazine)

Free Career Resources for Scientists

### A Twin Career Story

E. Pain

Identical twin brothers Alan and Steven Davy are pursuing similar research interests while also seeking to differentiate themselves.

<http://scim.ag/twinstory>

## Q&amp;A: Taking Mathematics to Heart

K. Travis

Mathematician John Wesley Cain works with clinicians, physicists, and engineers in a field called cardiac electrophysiology.

<http://scim.ag/math2heart>

## SCIENCE TRANSLATIONAL MEDICINE

[www.sciencetranslationalmedicine.org](http://www.sciencetranslationalmedicine.org)

Integrating Medicine and Science

27 April issue: <http://scim.ag/stm042711>

### RESEARCH ARTICLE: Establishment of Antitumor Memory in Humans Using in Vitro-Educated CD8<sup>+</sup> T Cells

M. O. Butler et al.

Antitumor CD8<sup>+</sup> T cells educated in vitro can induce antitumor responses in humans.

### REPORT: Differential Metabolic Impact of Gastric Bypass Surgery Versus Dietary Intervention in Obese Diabetic Subjects Despite Identical Weight Loss

B. Laferrère et al.

### PERSPECTIVE: Two Roads Diverge—Weight Loss Interventions and Circulating Amino Acids

R. E. Gerszten and T. J. Wang

Gastric bypass surgery decreases serum amino acids independent of weight loss.

### PERSPECTIVE: The NCGC Pharmaceutical Collection—A Comprehensive Resource of Clinically Approved Drugs Enabling Repurposing and Chemical Genomics

R. Huang et al.

The NIH Chemical Genomics Center houses a database and a library of approved drugs.

## SCIENCEPODCAST

[www.sciencemag.org/multimedia/podcast](http://www.sciencemag.org/multimedia/podcast)

Free Weekly Show

On the 29 April Science Podcast: dolphin research ethics, organic light-emitting transistors, your Letters to Science, and more

## SCIENCEINSIDER

[news.sciencemag.org/scienceinsider](http://news.sciencemag.org/scienceinsider)

Science Policy News and Analysis

SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005. Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Copyright © 2011 by the American Association for the Advancement of Science. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): \$149 (\$74 allocated to subscription). Domestic institutional subscription (51 issues): \$990; Foreign postage extra: Mexico, Caribbean (surface mail) \$55; other countries (air assist delivery) \$85. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Publications Mail Agreement Number 1069624. Printed in the U.S.A.

Change of address: Allow 4 weeks, giving old and new addresses and 8-digit account number. Postmaster: Send change of address to AAAS, P.O. Box 96178, Washington, DC 20090-6178. Single-copy sales: \$10.00 current issue, \$15.00 back issue prepaid includes surface postage; bulk rates on request. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that \$25.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. The identification code for Science is 0036-8075. Science is indexed in the Reader's Guide to Periodical Literature and in several specialized indexes.



ADVANCING SCIENCE, SERVING SOCIETY

# Science

**332 (6029)**

*Science* **332** (6029), 511-612.

**ARTICLE TOOLS**

<http://science.sciencemag.org/content/332/6029>

**PERMISSIONS**

<http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

---

*Science* (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. 2017 © The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. The title *Science* is a registered trademark of AAAS.