

## EDITORIAL

- 392 Driven by Basic Research  
*Peter Gruss*

## NEWS OF THE WEEK

- 396 A roundup of the week's top stories

## NEWS & ANALYSIS

- 399 California Weighs Tobacco Tax Hike to Fund Research  
>> *Report p. 466*
- 400 Ancient Migrants Brought Farming Way of Life to Europe  
>> *Report p. 466*
- 401 Spending Panels Back Boosts for NSF, NASA, NIST Programs
- 402 Despite Gains, Malnutrition Among China's Rural Poor Sparks Concern
- 403 Sarkozy's Foe Would Soften Reforms, Overturn Stem Cell Law
- 404 Textbook Electrodynamics May Contradict Relativity
- 405 The Greenhouse Is Making the Water-Poor Even Poorer  
>> *Report p. 455*

## NEWS FOCUS

- 406 Europe's Embarrassing Problem After a Successful Decade, Global Fight Appears Stalled  
>> *Science Podcast*
- 408 Experiments Probe Language's Origins and Development  
Where Time Goes Up and Down

## LETTERS

- 412 Chile's Research Planning Falls Short  
*P. Astudillo et al.*  
Don't Jump to Conclusions on Fraud  
*J. B. Losos*  
Finding Balance in Fisheries Management  
*S. M. Maxwell et al.*

- 413 CORRECTIONS AND CLARIFICATIONS  
413 TECHNICAL COMMENT ABSTRACTS

## BOOKS ET AL.

- 414 Wildlife, Wildlands, Water, and More

## POLICY FORUM

- 418 Monitoring EU Emerging Infectious Disease Risk Due to Climate Change  
*E. Lindgren et al.*

## PERSPECTIVES

- 420 Select Inflammasome Assembly  
*D. R. Caffrey and K. A. Fitzgerald*  
>> *Report p. 481*
- 421 Two Atomic Clocks Ticking as One  
*B. Warrington*  
>> *Report p. 441*
- 422 Microbial Evolution in the Wild  
*E. F. DeLong*  
>> *Report p. 462*
- 424 Complex Protostellar Chemistry  
*J. A. Nuth III and N. M. Johnson*  
>> *Report p. 452*
- 425 Using Cell-to-Cell Variability—A New Era in Molecular Biology  
*L. Pelkmans*
- 427 A Hard Life for Cyanobacteria  
*R. Riding*  
>> *Report p. 459*
- 428 Reprogramming the Genetic Code  
*J. W. Chin*

## SCIENCE PRIZE ESSAY

- 430 Engaging Undergraduates in Global Health Technology Innovation  
*R. Richards-Kortum et al.*

**CONTENTS** continued >>

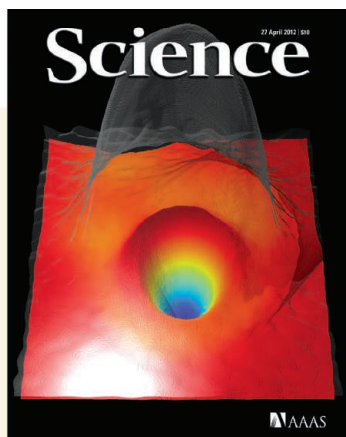


page 406



page 414

Downloaded from <http://science.sciencemag.org/> on November 17, 2017



## COVER

Overlaid scanning tunneling and atomic force microscopy images of a single atom (width 1.3 nanometers): tunneling current (gray veil) and force (colored surface) between a tungsten atom and a carbon monoxide molecule. The force shows a strong angular dependence and is attractive (blue minimum) in one direction and repulsive (dark red crescent) in others. The angular dependence of single chemical bonds determines the shape of molecules and crystals. See page 444.

*Image: Joachim Welker, University of Regensburg*

## DEPARTMENTS

- 389 This Week in *Science*  
393 Editors' Choice  
394 *Science* Staff  
432 AAAS News & Notes  
497 New Products  
498 *Science* Careers

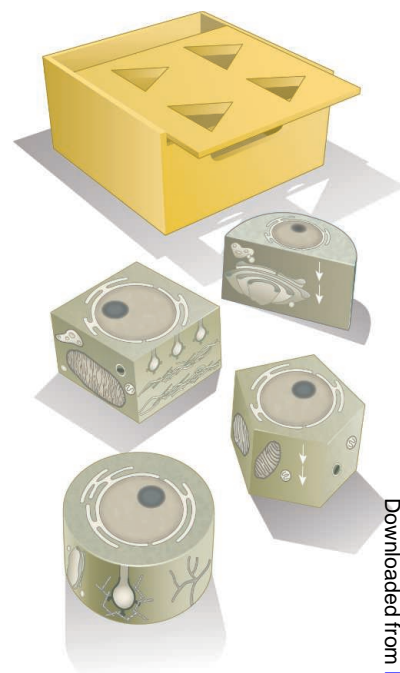
## REVIEW

- 434 **Multiblock Polymers: Panacea or Pandora's Box?**  
F. S. Bates et al.

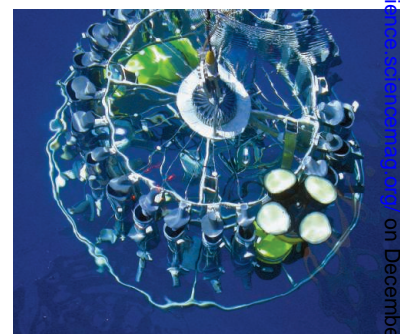
## REPORTS

- 441 **A 920-Kilometer Optical Fiber Link for Frequency Metrology at the 19th Decimal Place**  
K. Predehl et al.  
A long-distance fiber network is used to synchronize two optical clocks with high precision.  
>> *Perspective p. 421; Science Podcast*
- 444 **Revealing the Angular Symmetry of Chemical Bonds by Atomic Force Microscopy**  
J. Welker and F. J. Giessibl  
The angular dependence of chemical bonding forces was determined for carbon monoxide adsorbed on a copper surface atom.
- 449 **Coils and Polygonal Crust in the Athabasca Valles Region, Mars, as Evidence for a Volcanic History**  
A. J. Ryan and P. R. Christensen  
High-resolution images from the Mars Reconnaissance Orbiter show that the Athabasca Valles on Mars is volcanic in origin.
- 452 **Organic Synthesis via Irradiation and Warming of Ice Grains in the Solar Nebula**  
F. J. Ciesla and S. A. Sandford  
A mechanism for production of carbon compounds in the interstellar medium could also operate in protoplanetary disks.  
>> *Perspective p. 424*
- 455 **Ocean Salinities Reveal Strong Global Water Cycle Intensification During 1950 to 2000**  
P. J. Durack et al.  
Global sea surface salinity changes show that the water cycle has sped up markedly in the past 50 years.  
>> *News story p. 405*
- 459 **An Early-Branching Microbialite Cyanobacterium Forms Intracellular Carbonates**  
E. Couradeau et al.  
Certain cyanobacteria precipitate carbonate internally, in a previously unappreciated biomineralization pathway.  
>> *Perspective p. 427*

- 462 **In Situ Evolutionary Rate Measurements Show Ecological Success of Recently Emerged Bacterial Hybrids**  
V. J. Denef and J. F. Banfield  
The likely substitution rate per nucleotide per generation was estimated for a free-living microbial population.  
>> *Perspective p. 422*
- 466 **Origins and Genetic Legacy of Neolithic Farmers and Hunter-Gatherers in Europe**  
P. Skoglund et al.  
Genomic analysis of ancient Scandinavians reveals that agricultural expansion was driven by long-range population movement.  
>> *News story p. 400; Science Podcast*
- 470 **Endogenous Protein S-Nitrosylation in *E. coli*: Regulation by OxyR**  
D. Seth et al.  
Bacteria adapting to growth in the presence of nitrate activate a transcriptional regulator also involved in oxidative stress.
- 474 **Function and Molecular Mechanism of Acetylation in Autophagy Regulation**  
C. Yi et al.  
The acetyltransferase TIP60 functions specifically to promote autophagy in cells deprived of growth factors.
- 477 **GSK3-TIP60-ULK1 Signaling Pathway Links Growth Factor Deprivation to Autophagy**  
S.-Y. Lin et al.  
A signaling pathway is involved in cellular responses to serum starvation but not glucose starvation.
- 481 **GBP5 Promotes NLRP3 Inflammasome Assembly and Immunity in Mammals**  
A. R. Shenoy et al.  
A human protein activates the assembly of a cellular complex that detects signs of infection.  
>> *Perspective p. 420*
- 485 **The Inhibitory Receptor PD-1 Regulates IgA Selection and Bacterial Composition in the Gut**  
S. Kawamoto et al.  
An inhibitory receptor is important for gut microflora containment by immunoglobulin A.
- 489 **Microbial Exposure During Early Life Has Persistent Effects on Natural Killer T Cell Function**  
T. Olszak et al.  
Early exposure of germ-free mice to microbes keeps later inflammation in check by modulating immune cells.
- 493 **Analytic Thinking Promotes Religious Disbelief**  
W. M. Gervais and A. Norenzayan  
A dual-process theory posits a competition between analytical thought and religious belief.



page 425



pages 405 &amp; 455



pages 400 &amp; 466

CONTENTS continued &gt;&gt;

## SCIENCEONLINE

## SCIENCEEXPRESS

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

## The Crystal Structure of Human Argonaute2

*N. T. Schirle and I. J. MacRae*

The structure of the core protein of the human RNA interference machinery is determined at high resolution.

10.1126/science.1221551

## Quantitative Sequencing of 5-Methylcytosine and 5-Hydroxymethylcytosine at Single-Base Resolution

*M. J. Booth et al.*

A sequencing method can discriminate epigenetically modified cytosine nucleotides within embryonic stem cell DNA.

10.1126/science.1220671

## Neural Correlates of a Magnetic Sense

*L.-Q. Wu and J. D. Dickman*

Neurons in a pigeon's brain encode the direction and intensity of the geomagnetic field.

10.1126/science.1216567

## AID-Driven Deletion Causes Immunoglobulin Heavy Chain Locus Suicide Recombination in B Cells

*S. Péron et al.*

Recombination-induced deletion of the immunoglobulin heavy chain gene in activated B cells may influence B cell homeostasis.

10.1126/science.1218692

## Evolutionary Trade-Offs, Pareto Optimality, and the Geometry of Phenotype Space

*O. Shoval et al.*

The fitness of an organism can be modeled graphically to determine how phenotypic tradeoffs are maximized.

10.1126/science.1217405

## TECHNICAL COMMENTS

## Comment on "Universality in the Evolution of Orientation Columns in the Visual Cortex"

*Y. Meng et al.*

Full text at [www.sciencemag.org/cgi/content/ful/336/6080/413-c](http://www.sciencemag.org/cgi/content/ful/336/6080/413-c)

## Response to Comment on "Universality in the Evolution of Orientation Columns in the Visual Cortex"

*W. Keil et al.*

Full text at [www.sciencemag.org/cgi/content/ful/336/6080/413-d](http://www.sciencemag.org/cgi/content/ful/336/6080/413-d)

## SCIENCE NOW

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

Highlights From Our Daily News Coverage

## No Love for Comet Wipeout

Findings argue against extraterrestrial impact snuffing out mammoths and early Indians.

[http://scim.ag/Comet\\_Wipeout](http://scim.ag/Comet_Wipeout)

## Where's the Beef? Early Humans Took It

The rise of human hunting and scavenging drove large carnivores extinct, a new study suggests.

[http://scim.ag/Early\\_Humans](http://scim.ag/Early_Humans)

## Why Creepy People Give Us the Chills

Individuals who inappropriately mimic the body language of their peers can leave acquaintances feeling cold.

[http://scim.ag/Creepy\\_People](http://scim.ag/Creepy_People)

## SCIENCE SIGNALING

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

The Signal Transduction Knowledge Environment  
24 April issue: <http://scim.ag/ss042412>

RESEARCH ARTICLE: Differential  $\beta$ -Arrestin-Dependent Conformational Signaling and Cellular Responses Revealed by Angiotensin Analogs

*B. Zimmerman et al.*

The conformational changes induced in  $\beta$ -arrestin by angiotensin II analogs dictate the cellular response.

## RESEARCH RESOURCE: Studying the Dynamics of SLP-76, Nck, and Vav1 Multimolecular Complex Formation in Live Human Cells with Triple-Color FRET

*M. H. Pauker et al.*

The formation of a multiprotein complex in response to T cell activation is monitored in live cells.

## PERSPECTIVE: Linking NAADP to Ion Channel Activity—A Unifying Hypothesis

*A. H. Guse*

NAADP-mediated regulation of ion channels may occur through intermediary binding partners.

## JOURNAL CLUB: The Role of EHD Proteins at the Neuronal Synapse

*M. S. Ioannou and A. L. Marat*

EHD proteins promote synaptic vesicle formation by limiting the extent of dynamin helix formation.

## SCIENCE TRANSLATIONAL MEDICINE

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

Integrating Medicine and Science

25 April issue: <http://scim.ag/stm042512>

## RESEARCH ARTICLE: Looking Beyond Historical Patient Outcomes to Improve Clinical Models

*C.-C. Chia et al.*

## FOCUS: Thoroughly Modern Risk Prediction?

*M. J. Pencina and R. B. D'Agostino Sr.*

The computer revolution may facilitate new methods for the construction of models that predict clinical risk.

## RESEARCH ARTICLE: Negative Allosteric Modulation of the mGluR5 Receptor Reduces Repetitive Behaviors and Rescues Social Deficits in Mouse Models of Autism

*J. L. Silverman et al.*

## FOCUS: Tweaking the Social Network

*B. Gomez-Mancilla*

A preclinical mouse model of autism spectrum disorder paves the way for clinical trials with a glutamate receptor antagonist.

## RESEARCH ARTICLE: Suppression of Phosphoinositide 3-Kinase Signaling and Alteration of Multiple Ion Currents in Drug-Induced Long QT Syndrome

*Z. Lu et al.*

The dangerous heart arrhythmias that are triggered as a side effect of some drugs are caused by many ion channels, prompting a rethinking of how we screen for these adverse events.

## SCIENCE CAREERS

[www.sciencereers.org/career\\_magazine](http://www.sciencereers.org/career_magazine)  
Free Career Resources for Scientists

## Experimental Error: Thick Books and Thin Films

*A. Ruben*

Before you pick up that next thriller novel, remember that scientists are not exactly as they are often portrayed.

<http://scim.ag/HWU12v>

## In Person: Consulting for Career Enhancement

*M. Schillebeeckx et al.*

A group of grad students and postdocs has created a successful nonprofit consulting group to improve their private-sector employment prospects.

<http://scim.ag/J3woee>

## Another NPA Founder Speaks

*M. Price*

Today, NPA cofounder Karen Christopherson is Principal Scientist at a unit of Pfizer.

<http://scim.ag/Jsnjk2>

## SCIENCE PODCAST

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

On the 27 April Science Podcast: synchronizing optical clocks, the spread of Neolithic farming in Europe, a measles resurgence, and more.

## SCIENCE INSIDER

[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 © 2012 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 (\$74 allocated to subscription). 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 \$30.00 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

**336 (6080)**

*Science* **336** (6080), 389-497.

**ARTICLE TOOLS**

<http://science.sciencemag.org/content/336/6080>

**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.