

SPECIAL SECTION

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### COVER

Bacteria constructed from toy building bricks represent the potential of synthetic biology to design and construct genetic modules that can be used to introduce new functions into existing organisms or even to engineer new biological systems. A special section highlights how this field is contributing to our understanding of biology and harnessing this understanding to benefit humanity. See page 1235 and [www.sciencemag.org/special/syntheticbio](http://www.sciencemag.org/special/syntheticbio).

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## BREVIA

- 1257** Recently Formed Polyploid Plants Diversify at Lower Rates  
*I. Mayrose et al.*  
The doubling of genomes does not cause increased plant speciation unless the progenitor lineages are highly fit.

## RESEARCH ARTICLES

- 1258** Herschel Detects a Massive Dust Reservoir in Supernova 1987A  
*M. Matsuura et al.*  
The large amount of dust produced by this supernova may help explain the dust observed in young galaxies.  
>> *Perspective p. 1227*
- 1262** A Gustotopic Map of Taste Qualities in the Mammalian Brain  
*X. Chen et al.*  
Nonoverlapping hot spots for different classes of taste stimuli map topographically in the mouse insular cortex.  
>> *News story p. 1213*

## REPORTS

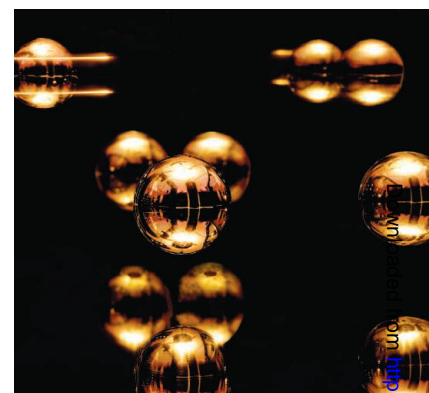
- 1266** Vacuum-Induced Transparency  
*H. Tanji-Suzuki et al.*  
The transmission of light through an atomic gas can be controlled by manipulating the confining cavity.  
>> *Perspective p. 1228*
- 1269** Single-Shot Correlations and Two-Qubit Gate of Solid-State Spins  
*K. C. Nowack et al.*  
Independent readout of two single-spin qubits in quantum dots is achieved in an all-electrical setup.
- 1273** Femtoscale Magnetically Induced Lattice Distortions in Multiferroic  $\text{TbMnO}_3$   
*H. C. Walker et al.*  
Ferroelectric order in a multiferroic compound is probably caused by small displacements of ions in its crystal lattice.
- 1276** Imaging the Microscopic Structure of Shear Thinning and Thickening Colloidal Suspensions  
*X. Cheng et al.*  
Confocal microscopy reveals changes in structures formed by suspended particles under different flow conditions.  
>> *Perspective p. 1230*
- 1279** Traffic Jams Reduce Hydrolytic Efficiency of Cellulase on Cellulose Surface  
*K. Igarashi et al.*  
High-speed atomic force microscopy tracks single-molecule dynamics of cellulose degradation into fermentable sugar molecules.
- 1282** Isotopic Signature of  $\text{N}_2\text{O}$  Produced by Marine Ammonia-Oxidizing Archaea  
*A. E. Santoro et al.*  
Archaea may account for the majority of marine nitrous oxide emissions to the atmosphere.

- 1285** Out of Tibet: Pliocene Woolly Rhino Suggests High-Plateau Origin of Ice Age Megaherbivores  
*T. Deng et al.*  
The Tibetan Plateau acted as a cradle of adaptation to cold for Pleistocene megafauna.
- 1289** Reconciling Food Production and Biodiversity Conservation: Land Sharing and Land Sparing Compared  
*B. Phalan et al.*  
Protecting the largest possible area of natural habitats while growing food on the smallest area can reconcile food production with conservation.  
>> *Perspective p. 1231*
- 1292** Chemical and Genetic Engineering of Selective Ion Channel–Ligand Interactions  
*C. J. Magnus et al.*  
Engineered ion channels enable manipulation of cellular function by selective chemical control of ionic conductance.  
>> *Synthetic Biology section p. 1235*
- 1296** Potential for Chemolithoautotrophy Among Ubiquitous Bacteria Lineages in the Dark Ocean  
*B. K. Swan et al.*  
Bacteria isolated from a deep seawater mass seem to fix carbon using energy from the oxidation of inorganic sulfur.
- 1300** Tet Proteins Can Convert 5-Methylcytosine to 5-Formylcytosine and 5-Carboxylcytosine  
*S. Ito et al.*
- 1303** Tet-Mediated Formation of 5-Carboxylcytosine and Its Excision by TDG in Mammalian DNA  
*Y.-F. He et al.*  
Evidence for a possible route for DNA demethylation in animals is suggested.  
>> *Perspective p. 1229*
- 1307** Multi-Input RNAi-Based Logic Circuit for Identification of Specific Cancer Cells  
*Z. Xie et al.*  
A synthetic biomolecular circuit identifies abnormal cell states by the integration of multiple endogenous microRNA inputs.  
>> *Synthetic Biology section p. 1235*
- 1311** Epigenetic Licensing of Germline Gene Expression by Maternal RNA in *C. elegans*  
*C. L. Johnson and A. M. Spence*  
Expression of a gene in an offspring needs an RNA (but not the protein it codes for) provided by its mother.
- 1315** Entrainment of a Population of Synthetic Genetic Oscillators  
*O. Mondragón-Palomino et al.*  
A positive-feedback loop in a biological oscillator allows effective setting of the clock by external cues.  
>> *Synthetic Biology section p. 1235*

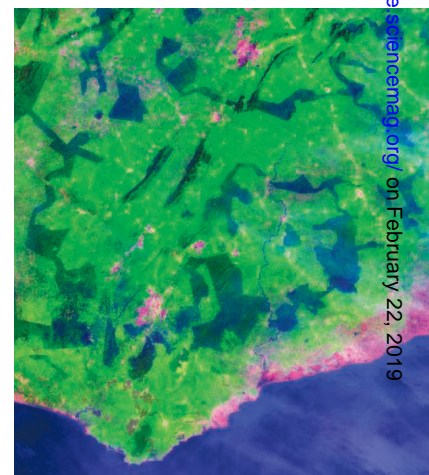
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## SCIENCEONLINE

## SCIENCEEXPRESS

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

**Light Propagation with Phase Discontinuities: Generalized Laws of Reflection and Refraction**  
*N. Yu et al.*

Light propagation can be controlled with plasmonic interfaces that introduce abrupt phase shifts along the optical path.

10.1126/science.1210713

**Linking Long-Term Dietary Patterns with Gut Microbial Enterotypes**

*G. D. Wu et al.*

The basic composition of the human gut microbiome is influenced by long-term diet: high fat and protein versus high fiber.

10.1126/science.1208344

**ER Tubules Mark Sites of Mitochondrial Division**  
*J. R. Friedman et al.*

Mitochondrial division occurs at positions where endoplasmic reticulum tubules contact mitochondria and mediate constriction.

10.1126/science.1207385

**Glutamatergic and Dopaminergic Neurons Mediate Anxiogenic and Anxiolytic Effects of CRHR1**

*D. Refojo et al.*

Imbalance in the bidirectional role of corticotropin-releasing hormone receptor 1 in anxiety might lead to emotional disorders.

10.1126/science.1202107

**Implementing the Quantum von Neumann Architecture with Superconducting Circuits**  
*M. Mariantoni et al.*

A quantum version of a central processing unit was created with superconducting circuits and elements.

10.1126/science.1208517

**Universal Digital Quantum Simulation with Trapped Ions**

*B. P. Lanyon et al.*

A series of trapped calcium ions was used to simulate the complex dynamics of an interacting spin system.

10.1126/science.1208001

## TECHNICALCOMMENTS

**Comment on "Additive Genetic Breeding Values Correlate with the Load of Partially Deleterious Mutations"**

*E. Postma*

Full text at [www.sciencemag.org/cgi/content/ful/333/6047/1221-b](http://www.sciencemag.org/cgi/content/ful/333/6047/1221-b)

>> *Retraction p. 1220*

## SCIENCENOW

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

Highlights From Our Daily News Coverage

**'Time Cells' Weave Events Into Memories**  
Neurons in the hippocampus keep track of empty moments.

<http://scim.ag/timecells>

**'Jurassic Mother' Found in China**

An ancestor of placental mammals appeared while dinosaurs roamed.

<http://scim.ag/jurassicmom>

**Mind-Altering Bugs**

Bacteria in the gut alter brain chemistry and behavior in mice.

<http://scim.ag/mind-altering>

## SCIENCE SIGNALING

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

The Signal Transduction Knowledge Environment

**30 August issue: <http://scim.ag/ss083011>**

**RESEARCH ARTICLE: AKT Promotes rRNA Synthesis and Cooperates with c-MYC to Stimulate Ribosome Biogenesis in Cancer**

*J. C. Chan et al.*

In addition to promoting translation, AKT also stimulates protein synthesis and cell growth by enhancing ribosome biogenesis.

**REVIEW: Inositol Pyrophosphates as Mammalian Cell Signals**

*A. Chakraborty et al.*

Identification and knockout of their biosynthetic enzymes has shed light on the diverse functions of the inositol pyrophosphates.

**PRESENTATION: Merlin/NF2 Functions Upstream of the Nuclear E3 Ubiquitin Ligase CRL4<sup>DCAF1</sup> to Suppress Oncogenic Gene Expression**

*J. Cooper et al.*

The closed conformer of Merlin inhibits tumorigenesis by inhibiting a ubiquitin ligase implicated in promoting cell cycle progression and inhibiting growth arrest, apoptosis, and adhesion.

## SCIENCE TRANSLATIONAL MEDICINE

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

Integrating Medicine and Science

**31 August issue: <http://scim.ag/stm083111>**

**RESEARCH ARTICLE: Identification of a Disease-Defining Gene Fusion in Epithelioid Hemangioendothelioma**

*M. R. Tanas et al.*

**PERSPECTIVE: Understanding the Enemy**

*V. E. Velculescu and L. A. Diaz Jr.*

A genomics approach shortens the path to discovery of a diagnostic gene fusion for a specific vascular cancer.

**RESEARCH ARTICLE: A Computational Model to Predict the Effects of Class I Anti-Arrhythmic Drugs on Ventricular Rhythms**

*J. D. Moreno et al.*

Two- and three-dimensional models of cardiac excitability based on sodium-channel kinetics can predict the adverse effects of class I anti-arrhythmic drugs.

**RESEARCH ARTICLE: Noninvasive Electroanatomic Mapping of Human Ventricular Arrhythmias with Electrocardiographic Imaging (ECGI)**

*Y. Wang et al.*

**FOCUS: Imaging Cardiac Arrhythmias**

*K. Shivkumar and S. M. Narayan*

Electrocardiographic imaging can noninvasively provide an activation map of the heart's surface to help treat arrhythmias.

## SCIENCE CAREERS

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

Free Career Resources for Scientists

**What Is Wrong With High-Skill Immigration Policy?**

*B. L. Benderly*

A Senate hearing highlights the split between institutions' and workers' interests.

[http://scim.ag/TFG\\_Skilled](http://scim.ag/TFG_Skilled)

**A Father-and-Son Journey Into Synthetic Biology**  
*E. Pain*

Justin Siegel rationally engineered unnatural enzymes partly thanks to technology his dad helped develop.

<http://scim.ag/JustinSiegel>

>> *Synthetic Biology section p. 1235 and [www.sciencemag.org/special/syntheticbio](http://www.sciencemag.org/special/syntheticbio)*

## SCIENCE PODCAST

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

Free Weekly Show

On the 2 September *Science* Podcast: a special show all about synthetic biology, from clinical applications and regulatory issues to the do-it-yourself biology movement.

>> *Synthetic Biology section p. 1235 and [www.sciencemag.org/special/syntheticbio](http://www.sciencemag.org/special/syntheticbio)*

## 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 © 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.

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**333 (6047)**

*Science* **333** (6047), 1199-1320.

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