



## COVER

Boulders and roots, or spores and hyphae? Parallel microscopic and macroscopic worlds merge in this detail from one of the winners of this year's *Science*/NSF International Science & Engineering Visualization Challenge. See the special section beginning on page 1767.

**Image: Colleen Champ, with micrographs by Dennis Kunkel**

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*by John Edward Porter*

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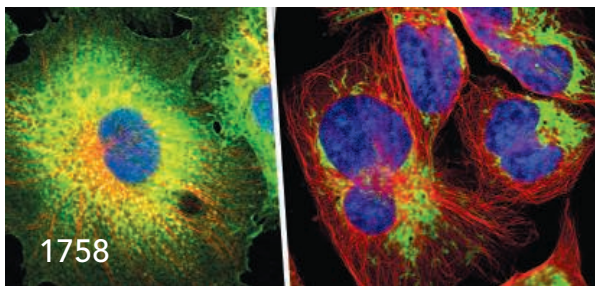
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For related online content, go to [www.sciencemag.org/vis2008/](http://www.sciencemag.org/vis2008/)

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*S. M. Fitzpatrick and J. T. Bruer*
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- Just Give Them Fellowships *A. P. Pernetta*
- Destabilizing the Pyramid Scheme *D. R. Jackola*
- Biotechnology Innovation in Africa *E. C. Agbo et al.*

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- The Race Between Education and Technology 1779  
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- Objectivity 1780  
*L. Daston and P. Galison, reviewed by A. Richardson*

## EDUCATION FORUM

- School Performance Will Fail to Meet Legislated Benchmarks 1781  
*M. J. Bryant et al.*

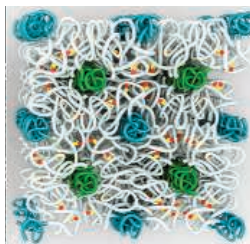
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*J. Oppenheim >> Report p. 1812*
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- Can Neural Data Improve Economics? 1788  
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- Nonlinear Thinking About Molecular Energy Transfer 1789  
*R. M. Stratt >> Report p. 1817*



Downloaded from <http://science.sciencemag.org/> on May 21, 2018

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## SCIENCE EXPRESS

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

### DEVELOPMENTAL BIOLOGY

#### Induced Pluripotent Stem Cells Generated Without Viral Integration

*M. Stadtfeld, M. Nagaya, J. Utikal, G. Weir, K. Hochedlinger*

Transient exposure of mouse fibroblast and liver cells to an adenovirus vector carrying factors that induce pluripotency generates stem cells without viral elements in the genome.

10.1126/science.1162494

### GENETICS

#### Conservation and Rewiring of Functional Modules Revealed by an Epistasis Map in Fission Yeast

*A. Roguev et al.*

Comparison of genetic wiring in two types of yeast reveals that protein complexes are conserved, but the interactions between them can change radically between species.

10.1126/science.1162609

### MATERIALS SCIENCE

#### Evolution of Block Copolymer Lithography to Highly Ordered Square Arrays

*C. Tang, E. M. Lennon, G. H. Fredrickson, E. J. Kramer, C. J. Hawker*

The addition of hydrogen bonding units to two block copolymers leads to a template with square patterns that can be used for manufacturing integrated circuits.

10.1126/science.1162950

### PHYSICS

#### Complete Characterization of Quantum-Optical Processes

*M. Lobino, D. Korystov, C. Kupchak, E. Figueroa, B. C. Sanders, A. I. Lvovsky*

A method requiring only the light from a laser as an input yields a full characterization of quantum optical processes by probing its effect on classical states.

10.1126/science.1162086

## REVIEW

### CHEMISTRY

#### Assembling Materials with DNA as the Guide

1795

*F. A. Aldaye, A. L. Palmer, H. F. Sleiman*

## BREVIA

### GEOPHYSICS

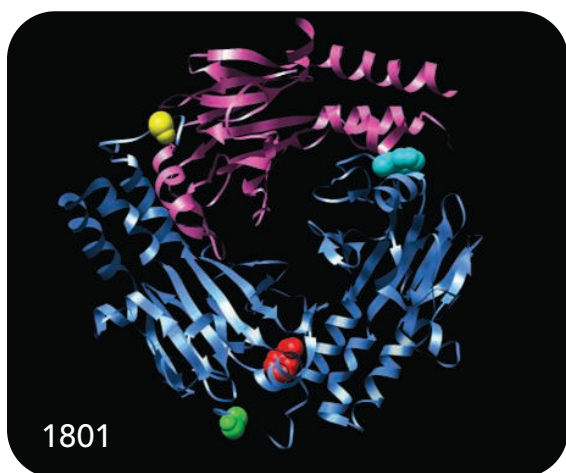
#### Magnetic Source Separation in Earth's Outer Core

1800

*K. A. Hoffman and B. S. Singer*

Analysis of Earth's magnetic field as it has changed and reversed suggests that its dipole arises from a distinct part of the outer core than that of the rest of the field.

>> *News story p. 1756*



1801

## RESEARCH ARTICLES

### MEDICINE

#### Core Signaling Pathways in Human Pancreatic Cancers Revealed by Global Genomic Analyses

1801

*S. Jones et al.*

Sequencing of DNA mutations shows that the same 12 signaling pathways are disrupted in most pancreatic tumors, suggesting these as key to tumor development.

### MEDICINE

#### An Integrated Genomic Analysis of Human Glioblastoma Multiforme

1807

*D. W. Parsons et al.*

Comprehensive analysis of mutations in a brain cancer identifies previously unidentified cancer genes and a frequently mutated protein that may serve as a therapeutic marker.

## REPORTS

### PHYSICS

#### Quantum Communication with Zero-Capacity Channels

1812

*G. Smith and J. Yard*

Two quantum communication channels, each of which is so noisy that it has zero capacity to independently transmit information, can do so when used together.

>> *Perspective p. 1783*

### CHEMISTRY

#### Synthesis and Solid-State NMR Structural Characterization of <sup>13</sup>C-Labeled Graphite Oxide

1815

*W. Cai et al.*

Solid-state nuclear magnetic resonance study of graphite oxide made with 100 percent carbon-13 reveals a complex bonding network involving several carbon species.

CONTENTS continued >>

## REPORTS CONTINUED...

### CHEMISTRY

#### Linear Response Breakdown in Solvation Dynamics Induced by Atomic Electron-Transfer Reactions 1817

*A. E. Bragg, M. C. Cavanagh, B. J. Schwartz*

A solvent equilibrates faster around a sodium-electron ion pair formed from Na<sup>+</sup> than from Na<sup>-</sup>, violating a widely used approximation for modeling solvent dynamics.

>> *Perspective p. 1789*

### PLANETARY SCIENCE

#### Mars' Paleomagnetic Field as the Result of a Single-Hemisphere Dynamo 1822

*S. Stanley, L. Elkins-Tanton, M. T. Zuber, E. M. Parmentier*

A model of Mars' early magnetic field with a north-south gradient in heat flow from the core yields a strong field only in the south, explaining the relic magnetism in the crust.

>> *News story p. 1756; Perspective p. 1784*

### GEOPHYSICS

#### The Structure and Dynamics of Mid-Ocean Ridge Hydrothermal Systems 1825

*D. Coumou, T. Driesner, C. A. Heinrich*

A three-dimensional model shows that mid-ocean hydrothermal systems self-organize into broad warm downflows feeding narrow, pipelike hot upflows.

### GEOCHEMISTRY

#### Neodymium-142 Evidence for Hadean Mafic Crust 1828

*J. O'Neil, R. W. Carlson, D. Francis, R. K. Stevenson*

An unusual isotopic anomaly in rocks along the Hudson Bay suggests that they formed 4.28 billion years ago and support early formation of a separate reservoir in Earth's mantle.

>> *News story p. 1755; Science Podcast*

### PSYCHOLOGY

#### Infants' Perseverative Search Errors Are Induced by Pragmatic Misinterpretation 1831

*J. Topál, G. Gergely, Á. Miklósi, Á. Erdőhegyi, G. Csibra*

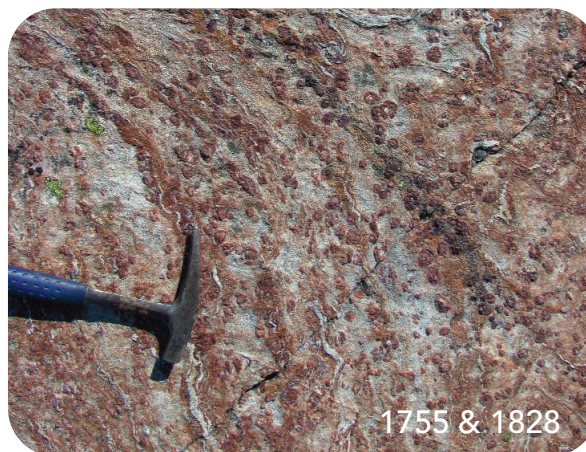
Infants may make mistakes in certain tasks because of the powerful effects of social interaction with an adult, not because of brain immaturity as was previously assumed.

### BIOCHEMISTRY

#### Antigen Recognition by Variable Lymphocyte Receptors 1834

*B. W. Han, B. R. Herrin, M. D. Cooper, I. A. Wilson*

The receptor that binds antigens in jawless vertebrates differs from the immunoglobulins of jawed vertebrates and uses a variable concave surface and Carboxyl terminal for recognition.



### MEDICINE

#### Disruption of the CFTR Gene Produces a Model of Cystic Fibrosis in Newborn Pigs 1837

*C. S. Rogers et al.*

Newborn pigs carrying a mutated copy of the gene defective in cystic fibrosis exhibit many features of the human disease and may provide fresh insights for therapy.

### MEDICINE

#### Seeding and Propagation of Untransformed Mouse Mammary Cells in the Lung 1841

*K. Podsypanina et al.*

In mice, normal mammary cells can colonize the lung, suggesting that metastases might arise from displaced normal cells acquiring genetic changes that confer malignancy.

>> *Perspective p. 1785*

### PSYCHOLOGY

#### The Coevolution of Cultural Groups and Ingroup Favoritism 1844

*C. Efferson, R. Lalive, E. Fehr*

Results of a laboratory game show that cultural groups and ingroup favoritism arise spontaneously when individuals display an external marker that predicts their actions.

### PSYCHOLOGY

#### Understanding Overbidding: Using the Neural Circuitry of Reward to Design Economic Auctions 1849

*M. R. Delgado, A. Schotter, E. Y. Ozbay, E. A. Phelps*

Brain areas sensitive to loss are selectively engaged during bidding in an auction, suggesting that the desire to avoid loss underlies the phenomenon of overbidding. >> *Perspective p. 1788*



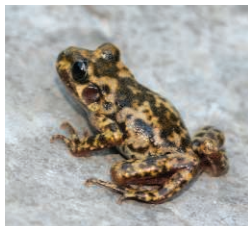
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Toad troubles.

## SCIENCE NOW

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HIGHLIGHTS FROM OUR DAILY NEWS COVERAGE

### Conservation Efforts May Have Backfired for Spanish Toad

A potentially deadly fungus was accidentally introduced as part of a breeding program for an endangered amphibian.

### Wasps Make Peace With Past Enemies

The insects steer clear of foes they have fought in the past.

### Fat Molecule Fights Weight Gain

Compound prevents mice from storing unhealthy fat.



Dave Jensen tools up his own career.

## SCIENCE CAREERS

[www.sciencereers.org/career\\_development](http://www.sciencereers.org/career_development)

FREE CAREER RESOURCES FOR SCIENTISTS

### Tooling Up: My Career Dissected

*D. Jensen*

Dave Jensen highlights some of his own career mistakes.

### From Watching 'The Expert' to Being an Expert

*L. Cahoon*

Melanie Lee attributes her success partly to a childhood TV show.

### Union Aftershocks in California

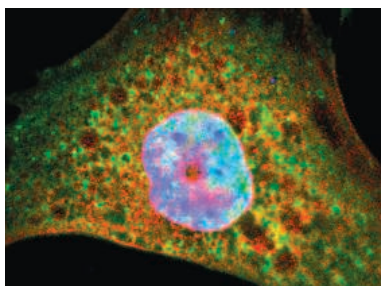
*C. Rey*

Postdocs and others in the University of California system adjust to life with a union.

### The Science Careers Web Log

*Science Careers Staff*

Here's where to find information from around the Web on careers in the sciences.



Intracellular colocalization of Grb10 and IGF-1 receptors.

## SCIENCE SIGNALING

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

THE SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

### RESEARCH ARTICLE: Nedd4 Controls Animal Growth by Regulating IGF-1 Signaling

*X. R. Cao, N. L. Lill, N. Boase, P. P. Shi, D. R. Croucher, H. Shan, J. Qu, E. M. Sweezer, T. Place, P. A. Kirby, R. J. Daly, S. Kumar, B. Yang*  
Nedd4 acts through Grb10 to enhance insulin-like growth factor signaling and control animal growth.

### PERSPECTIVE: Caspase-2—Vestigial Remnant or Master Regulator?

*C. M. Troy and E. M. Ribe*

Both mitochondrial-dependent and -independent cell death pathways are mediated by caspase-2.

### PODCAST

*E. M. Adler, N. R. Gough, A. M. VanHook*

Bacteria secrete factors that regulate genes that contribute to virulence.

## SCIENCE PODCAST

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