



COVER

Millions of books written before the computer era are being digitized for preservation. Because the ink has faded, optical character recognition software cannot decipher many words. Through a repurposing of an existing online security technology called CAPTCHA, these words are being manually transcribed by millions of Web users. See page 1465.

Photo: Joshua Franzos

DEPARTMENTS

- 1411 Science Online
- 1413 This Week in *Science*
- 1419 Editors' Choice
- 1422 Contact *Science*
- 1425 Random Samples
- 1427 Newsmakers
- 1511 New Products
- 1513 Science Careers

EDITORIAL

- 1417 Mediterranean Scientopolitics
by Ahmed Zewail

NEWS OF THE WEEK

- U.K. Education Reform: Too Much of a Good Thing? 1428
- Brainy Babies and Risky Births for Neandertals 1429
- India Hopes New Fellowships Will Attract Expat Scientists 1431

SCIENCESCOPE 1431

- Broad Gives \$400 Million More to Cambridge Institute 1432
- McCain, Obama Present Their Wars on Cancer 1432
- Quantum Flashlight Pierces the Darkness With a Few Percent as Many Photons 1433

>> Report p. 1463

NEWS FOCUS

- The Mushroom Cloud's Silver Lining 1434
Forgers Face the Nuclear Option
>> Science Podcast
- Obama and McCain Are Swept Up in a Surprising Space Race 1438
New Institute Shoots for the Moon
- The Houbara: Headed for Oblivion? 1441



1434

LETTERS

- Working the Crowd *A. Gaggioli and G. Riva* 1443
- Southern Ocean Not So Pristine
L. K. Blight and D. G. Ainley
- Diminishing Sea Ice *G. C. Ray et al.*
Response *B. S. Halpern et al.*
- Microscopy for Life Scientists *N. J. Fullwood*
- Archaeology Without Borders *S. K. Basu*

CORRECTIONS AND CLARIFICATIONS 1446

BOOKS ET AL.

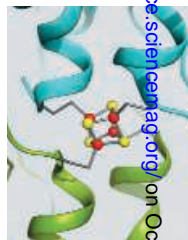
- Worlds Before Adam The Reconstruction of Geohistory in the Age of Reform 1447
M. J. S. Rudwick, reviewed by R. J. O'Connor
- The Animal Research War 1448
P. M. Conn and J. V. Parker, reviewed by D. C. Runkle

POLICY FORUM

- Do We Need "Synthetic Bioethics"? 1449
E. Parens, J. Johnston, J. Moses

PERSPECTIVES

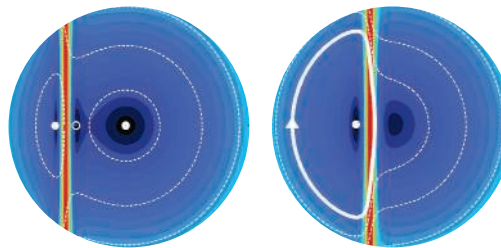
- Return to the Proliferative Pool 1450
A. González-Reyes and J. Casanova >> Report p. 1496
- Dynamics of Body Size Evolution 1451
K. Roy
- Bringing Stability to Highly Reduced Iron-Sulfur Clusters 1452
E. Münck and E. L. Bominaar
- Understanding Soil Time 1454
S. L. Brantley >> Perspective p. 1455
- An Uncertain Future for Soil Carbon 1455
S. E. Trumbore and C. I. Czimczik >> Perspective p. 1454



1452

Downloaded from <http://science.sciencemag.org/> on October 18, 2019

CONTENTS continued >>



SCIENCE EXPRESS

www.scienceexpress.org

GENETICS

Species-Specific Transcription in Mice Carrying Human Chromosome 21
M. D. Wilson et al.

An aneuploid mouse carrying a human chromosome shows that genetic sequence can dominate epigenetic, cellular, and organismal effects in determining transcriptional regulation and gene expression.

10.1126/science.1160930

CLIMATE CHANGE

Atmospheric CO₂ and Climate on Millennial Time Scales During the Last Glacial Period

J. Ahn and E. J. Brook

A detailed gas record from the Byrd ice core from 90,000 to 20,000 years ago shows that warming episodes tracked high CO₂ levels in Antarctica but lagged by several thousands of years in Greenland.

10.1126/science.1160832

APPLIED PHYSICS

Cavity Optomechanics with a Bose-Einstein Condensate

F. Brennecke, S. Ritter, T. Donner, T. Esslinger

Coupling a Bose-Einstein condensate to an optical cavity holding a few trapped photons provides a sensitive probe of mechanical oscillations in the quantum regime.

10.1126/science.1163218

CLIMATE CHANGE

Northern Hemisphere Controls on Tropical Southeast African Climate During the Past 60,000 Years

J. E. Tierney et al.

Abrupt changes in precipitation and temperature resolved in a record spanning the past 60,000 years from Lake Tanganyika, East Africa, are coeval with Northern Hemisphere climate events.

10.1126/science.1160485

TECHNICAL COMMENT ABSTRACTS

ECOLOGY

Comment on "A Global Map of Human Impact on Marine Ecosystems" 1446

M. R. Heath

[full text at www.sciencemag.org/cgi/content/full/321/5895/1446b](http://www.sciencemag.org/cgi/content/full/321/5895/1446b)

Response to Comment on "A Global Map of Human Impact on Marine Ecosystems"

K. A. Selkoe et al.

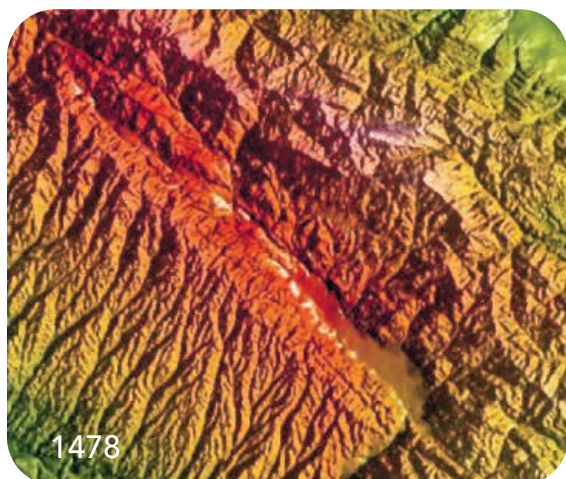
[full text at www.sciencemag.org/cgi/content/full/321/5895/1446c](http://www.sciencemag.org/cgi/content/full/321/5895/1446c)

REVIEW

APPLIED PHYSICS

Cooling, Heating, Generating Power, and Recovering Waste Heat with Thermoelectric Systems 1457

L. E. Bell



BREVIA

GENETICS

A Mutation in Hairless Dogs Implicates *FOXI3* in Ectodermal Development 1462

C. Drögemüller et al.

Mutations in a transcription factor gene involved in ectodermal development cause a lack of hair and abnormal teeth in Chinese Crested, Mexican, and Peruvian hairless dogs.

REPORTS

PHYSICS

Enhanced Sensitivity of Photodetection via Quantum Illumination 1463

S. Lloyd

Quantum-mechanically entangled light, in which one photon is kept as a reference, can exponentially improve the imaging of an object, as compared with unentangled illumination. >> [News story p. 1433](#)

COMPUTER SCIENCE

reCAPTCHA: Human-Based Character Recognition via Web Security Measures 1465

L. von Ahn et al.

A security system that relies on the superior performance of humans in comparison to computers in reading distorted text can be harnessed for digitized scanned documents.

MATERIALS SCIENCE

A Rubberlike Stretchable Active Matrix Using Elastic Conductors 1468

T. Sekitani et al.

A carbon nanotube-polymer film containing organic transistors and coated with silicon rubber can maintain its electrical properties while being stretched up to 70 percent.

CONTENTS continued >>

REPORTS CONTINUED...

MATERIALS SCIENCE

Imaging of Transient Structures Using Nanosecond in Situ TEM 1472

J. S. Kim et al.

Rapidly pulsing electrons through a transmission electron microscope allows imaging of localized cooling and phase separation along a propagating reaction front in a laminate. >> *Science Podcast*

PLANETARY SCIENCE

The Magnetic Memory of Titan's Ionized Atmosphere 1475

C. Bertucci et al.

Cassini observations show that Saturn's moon Titan retains an imprinted memory of Saturn's magnetic field above its ionosphere, even after passing outside the field.

GEOPHYSICS

Postseismic Relaxation Along the San Andreas Fault at Parkfield from Continuous Seismological Observations 1478

F. Brenguier et al.

Correlating 5 years of seismic noise among nearby receivers reveals subtle seismic velocity signals reflecting changes in the properties of the San Andreas fault at Parkfield.

ATMOSPHERIC SCIENCE

Atmospheric Warming and the Amplification of Precipitation Extremes 1481

R. P. Allan and B. J. Soden

Satellite data show that in the tropics, heavy rain events have increased in warmer months and decreased in colder months, more than predicted by climate models.

PALEONTOLOGY

Superiority, Competition, and Opportunism in the Evolutionary Radiation of Dinosaurs 1485

S. L. Brusatte, M. J. Benton, M. Ruta, G. T. Lloyd

During their early radiation, dinosaur morphology evolved at comparable rates to that of competing archosaurs, implying that opportunity, not superiority, influences their success.

ECOLOGY

Niche Partitioning Increases Resource Exploitation by Diverse Communities 1488

D. L. Finke and W. E. Snyder

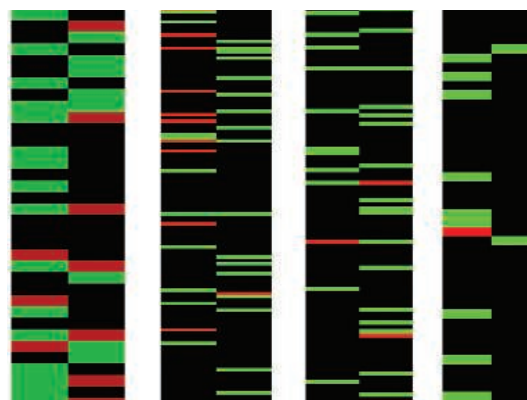
In an ecosystem comprising a parasite, an aphid, and a radish, the use of different resources by each species, not species diversity per se, increases overall consumption.

MOLECULAR BIOLOGY

Degradation of microRNAs by a Family of Exoribonucleases in *Arabidopsis* 1490

V. Ramachandran and X. Chen

A class of nucleases specific for short single-stranded RNAs is found to degrade microRNAs in *Arabidopsis*; their mutation results in numerous developmental defects.



1499

MEDICINE

Activation of Aldehyde Dehydrogenase-2 Reduces Ischemic Damage to the Heart 1493

C.-H. Chen et al.

A compound that activates the mitochondrial enzyme aldehyde dehydrogenase-2 reduces the extent of heart damage in a rodent model of heart attack. >> *Science Podcast*

DEVELOPMENTAL BIOLOGY

Dual Origin of Tissue-Specific Progenitor Cells in *Drosophila* Tracheal Remodeling 1496

M. Weaver and M. A. Krasnow

When fruit flies metamorphose from larvae, a new trachea forms both from undifferentiated cells of the imaginal disc and differentiated cells that re-enter the cell cycle.

>> *Perspective p. 1450*

CELL BIOLOGY

FBXW7 Targets mTOR for Degradation and Cooperates with PTEN in Tumor Suppression 1499

J.-H. Mao et al.

A tumor suppressor is shown to control the degradation of a central protein regulator of cell proliferation.

NEUROSCIENCE

Unsupervised Natural Experience Rapidly Alters Invariant Object Representation in Visual Cortex 1502

N. Li and J. J. DiCarlo

Neurons in the most complex area of the brain's visual cortex can respond to a particular object in any orientation by rapidly learning to associate multiple views of that object.

CELL BIOLOGY

Conformational Switch of Syntaphin-1 Controls Synaptic Vesicle Fusion 1507

S. H. Gerber et al.

The synaptic vesicle protein that mediates membrane fusion during exocytosis also regulates the rate and extent of this process by controlling vesicle tethering.



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 © 2008 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): \$144 (\$74 allocated to subscription). Domestic institutional subscription (51 issues): \$770; 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. SCIENCE is printed on 30 percent post-consumer recycled paper. 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 \$20.00 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.



Printed on
30% post-consumer
recycled paper.

CONTENTS continued >>>



Homely but hardy.

SCIENCE NOW

www.sciencenow.org

HIGHLIGHTS FROM OUR DAILY NEWS COVERAGE

"Water Bears" Survive Earth Orbit

Hardy little creatures shrug off extremes of life outside a spacecraft.

Finding a Guy Who Looks Like Dear Old Dad

Men and women choose partners who resemble their own parents.

A Knack for Numbers

Kids who are good at judging relative quantities are also good at math.



How to deal with journalists.

SCIENCE CAREERS

www.sciencereers.org/career_development

FREE CAREER RESOURCES FOR SCIENTISTS

Your Research in the Headlines—Dealing With the Media *E. Pain*

Being prepared can improve the odds that your scientific work is portrayed accurately in the media.

Team Science and the Diversity Advantage

C. Rey

Do scientists with experiences in different cultures have an advantage in an era of team science?

In Person—Peter Brown, Patent Attorney

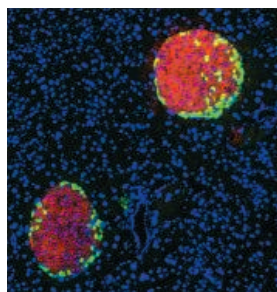
P. Brown

An award-winning New Zealand scientist tells why he decided to move from the bench to the bar.

International Grants and Fellowship Index

GrantsNet Staff

Learn about the latest funding opportunities from Europe, Asia, and the Americas.



Pancreatic islets in p110β mutant mice.

SCIENCE SIGNALING

www.sciencesignaling.org

THE SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

RESEARCH ARTICLE: Phosphoinositide 3-Kinase p110β Activity—Key Role in Metabolism and Mammary Gland Cancer but Not Development

E. Ciraolo, M. Iezzi, R. Marone, S. Marengo, C. Curcio, C. Costa, O. Azzolino, C. Gonella, C. Rubinetto, H. Wu, W. Dastrù, E. L. Martin, L. Silengo, F. Altruda, E. Turco, L. Lanzetti, P. Musiani, T. Rückle, C. Rommel, J. M. Backer, G. Forni, M. P. Wymann, E. Hirsch

The phosphoinositide 3-kinase p110β subunit has noncatalytic functions; its catalytic activity is pertinent to both diabetes and cancer.

PERSPECTIVE: Smad Signaling Dynamics—Insights from a Parsimonious Model

H. Shankaran and H. S. Wiley

Computational modeling of protein localization dynamics yields new information about Smad signaling.

GLOSSARY

Find out what Kir, Vg1, and YAP mean in the world of cell signaling.

SCIENCE PODCAST

www.sciencemag.org/multimedia/podcast
FREE WEEKLY SHOW

Download the 12 September *Science* Podcast to hear about damage control for the heart, imaging transient phenomena, a silver lining of atomic bomb testing, and more.



Separate individual or institutional subscriptions to these products may be required for full-text access.

Science

321 (5895)

Science **321** (5895), 1413-1518.

ARTICLE TOOLS

<http://science.sciencemag.org/content/321/5895>

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. The title *Science* is a registered trademark of AAAS.

Copyright © 2008 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works.