



Science

4 September 2009 | \$10

Programa de
Biotecnología
004



 AAAS

EDITORIAL

- 1181 Galvanizing Science Departments
Carl Wieman

NEWS OF THE WEEK

- 1188 Disrupting Hedgehog May Reverse Advanced Cancer, If Only Temporarily
>> *Science Express Report by R. L. Yauch et al.*
- 1189 Ancient DNA Says Europe's First Farmers Came From Afar
>> *Science Express Report by B. Bramanti et al.*
- 1190 Venezuela: Dismissal of Senior Scientist for 'Nonattendance' Shakes Community
- 1190 Science Needs Kids With Vision
- 1191 From *Science's* Online Daily News Site
- 1192 Last Chance to Save the 'Panda of Indochina'
Dam Project Reveals Secret Sanctuary of Vanishing Deer
- 1193 Japan: How Will Science Fare?
- 1193 From the *Science* Policy Blog
- 1194 The Case of the Midwife Toad: Fraud or Epigenetics?
- 1195 Potent HIV Antibodies Spark Vaccine Hopes
>> *Science Express Report by L. M. Walker et al.*

NEWS FOCUS

- 1196 ORIGINS
On the Origin of Cooperation
>> *Perspective p. 1213; Reports pp. 1269 and 1272; Science Podcast*
- 1200 American Chemical Society Fall Meeting
Sugary Achilles' Heel Raises Hope for Broad-Acting Antiviral Drugs
New Trick for Splitting Water With Sunlight
Altered Microbes Make Dark-Horse Biofuels

LETTERS

- 1203 Teaching and Learning Strategies That Work
R. Hoffmann and S. Y. McGuire
Science-Savvy Physicians
J. Chakma
A Step Toward Unification
N. King and D. Penman

TECHNICAL COMMENT ABSTRACTS

BOOKS ET AL.

- 1207 Principles of Evolutionary Medicine
P. Gluckman et al., reviewed by P. T. Ellison
- 1208 Weather Matters
B. Mergen, reviewed by R. Turner

POLICY FORUM

- 1209 Agricultural Research, Productivity, and Food Prices in the Long Run
J. M. Alston et al.

PERSPECTIVES

- 1211 Re-viewing an Old Comet Reservoir
M. Duncan
>> *Report p. 1234*
- 1212 Genetic Constraints on Adaptation?
J. Merilä
>> *Report p. 1244*
- 1213 Like Infant, Like Dog
M. Tomasello and J. Kaminski
>> *News story p. 1196; Reports pp. 1269 and 1272*
- 1214 Erasing Fear Memories
T. Pizzorusso
>> *Report p. 1258*
- 1215 Threats to Freshwater Fish
A. E. Magurran

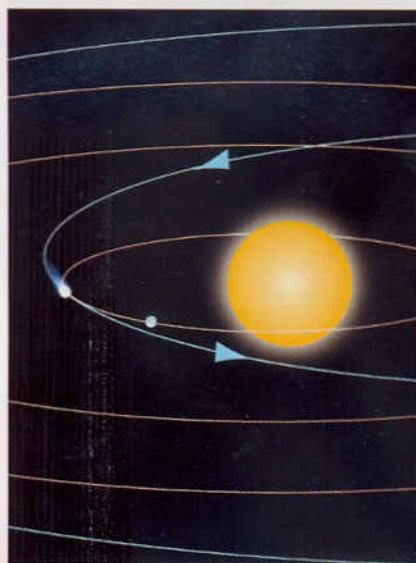
REVIEW

- 1217 Conserved Functions of Membrane Active GTPases in Coated Vesicle Formation
T. J. Pucadyil and S. L. Schmid

CONTENTS continued >>



page 1196



pages 1211 & 1234



COVER

Ants live together in highly complex societies, often sacrificing individual gain to achieve common goals such as forming a living bridge. Such cooperation makes evolutionary sense because the ants are all related, as detailed in this month's Origins essay on page 1196. The essay and two Reports on pages 1269 and 1272 address how cooperation evolves in unrelated individuals and even between species.

Photo credit: iStockphoto.com/Anders Boman

DEPARTMENTS

- 1178 This Week in *Science*
1182 Editors' Choice
1184 *Science* Staff
1187 Random Samples
1276 Gordon Research Conferences
1289 New Products
1290 *Science* Careers

BREVIA

- 1221** Shor's Quantum Factoring Algorithm on a Photonic Chip

A. Politi et al.

A quantum algorithm to factor numbers is implemented on an optical chip.

REPORTS

- 1222** An Ultramassive, Fast-Spinning White Dwarf in a Peculiar Binary System

S. Mereghetti et al.

X-ray observations show that a white dwarf has a mass near the limit above which these stars become gravitationally unstable.

- 1224** Realization of an Excited, Strongly Correlated Quantum Gas Phase

E. Haller et al.

Confinement of a cloud of ultracold atoms along one dimension creates tunable metastable excited states.

- 1227** Complete Methods Set for Scalable Ion Trap Quantum Information Processing

J. P. Home et al.

Coupling of different ion creates states that are insensitive to stray magnetic fields and more robust for quantum computing.

- 1230** A Sulfilimine Bond Identified in Collagen IV

R. Vanacore et al.

An unusual sulfilimine bond provides reinforcing cross-link of an extracellular matrix protein, collagen IV.

- 1234** Reassessing the Source of Long-Period Comets

N. A. Kaib and T. Quinn

Numerical simulations show that the inner Oort Cloud is a major source of long-period comets that cross Earth's orbit.

>> *Perspective p. 1211*

- 1236** Recent Warming Reverses Long-Term Arctic Cooling

D. S. Kaufman et al.

A 2000-year-long Arctic cooling trend seen in a surface air temperature reconstruction was reversed during the last century.

- 1240** Poly(ADP-ribose)-Dependent Regulation of DNA Repair by the Chromatin Remodeling Enzyme ALC1

D. Ahel et al.

A chromatin remodeling complex targeted by poly(ADP-ribose) plays a role in DNA repair.

- 1244** Fundamental Evolutionary Limits in Ecological Traits Drive *Drosophila* Species Distributions

V. Kellermann et al.

The evolutionary potential of key traits may be restricted by limited genetic variation.

>> *Perspective p. 1212*

- 1246** Common Regulatory Variation Impacts Gene Expression in a Cell Type-Dependent Manner

A. S. Dimas et al.

Genetic variation in regulatory elements among humans affects gene expression in a tissue-specific manner.

- 1250** Rab35 Controls Actin Bundling by Recruiting Fascin as an Effector Protein

J. Zhang et al.

Development of sensory bristles in flies depends on controlling the colocalization of actin assembly on membranes.

- 1254** Regulation of Histone Acetylation in the Nucleus by Sphingosine-1-Phosphate

N. C. Hait et al.

A phospholipid that binds to nuclear enzymes modifies gene transcription in response to external stimuli.

- 1258** Perineuronal Nets Protect Fear Memories from Erasure

N. Gogolla et al.

Fearful memories in adults are difficult to erase because of the physical environment of specific neurons in the brain.

>> *Perspective p. 1214*

- 1261** Activation of the PI3K Pathway in Cancer Through Inhibition of PTEN by Exchange Factor P-REX2a

B. Fine et al.

Cancer cell growth is stimulated by the inhibition of a previously unknown step in cell signaling for tumor suppression.

- 1265** Recruitment of Antigen-Specific CD8⁺ T Cells in Response to Infection Is Markedly Efficient

J. W. J. van Heijst et al.

Lymphocyte proliferation, more than recruitment to the site of an infection, determines the success of the immune response.

- 1269** Differential Sensitivity to Human Communication in Dogs, Wolves, and Human Infants

J. Topál et al.

Social interactions with humans govern the way dogs and children learn, but wolves learn by focusing on objects.

- 1272** Positive Interactions Promote Public Cooperation

D. G. Rand et al.

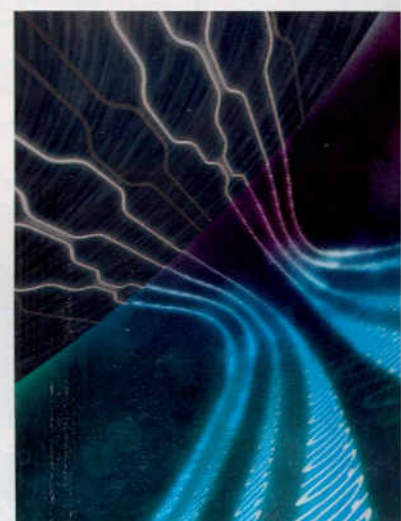
Reward is as good as punishment to promote cooperation, costs less, and increases the share out of resources up for grabs.

>> *News story p. 1196; Perspective p. 1213; Science Podcast*

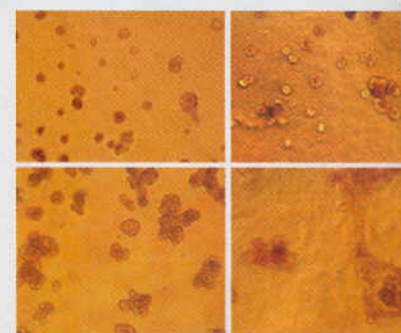
CONTENTS continued >>



page 1215



page 1221



page 1261

SCIENCEONLINE

SCIENCEEXPRESS

www.sciencexpress.org

Dirac Strings and Magnetic Monopoles in

Spin Ice $\text{Dy}_2\text{Ti}_2\text{O}_7$

D. J. P. Morris et al.

10.1126/science.1178868

Magnetic Coulomb Phase in the Spin Ice $\text{Ho}_2\text{Ti}_2\text{O}_7$

T. Fennell et al.

Neutron scattering measurements on two spin-ice compounds show evidence for magnetic monopoles.

10.1126/science.1177582

Unbiased Reconstruction of a Mammalian Transcriptional Network Mediating Pathogen Responses

I. Amit et al.

Inflammatory and antiviral programs in dendritic cells are controlled and tuned by a network of regulators.

10.1126/science.1179050

Broad and Potent Neutralizing Antibodies from an African Donor Reveal a New HIV-1 Vaccine Target

L. M. Walker et al.

High-throughput screening has revealed two new broadly neutralizing antibodies from a clade-A-infected donor in Africa.

10.1126/science.1178746

>> News story p. 1195

Genetic Discontinuity Between Local Hunter-Gatherers and Central Europe's First Farmers

B. Bramanti et al.

Skeletal DNA shows the relationship between Ice Age hunter-gatherers, the first farmers, and modern Europeans.

10.1126/science.1176869

>> News story p. 1189

Smoothered Mutation Confers Resistance to a Hedgehog Pathway Inhibitor in Medulloblastoma

R. L. Yauch et al.

A mutation that prevents binding of a promising drug lead to its target protein confers resistance in a human brain tumor.

10.1126/science.1179386

>> News story p. 1188

TECHNICALCOMMENTS

Comment on "Energy Uptake and Allocation During Ontogeny"

A. M. Makarieva et al.

full text at www.sciencemag.org/cgi/content/full/325/5945/1206-a

Comment on "Energy Uptake and Allocation During Ontogeny"

T. Sousa et al.

full text at www.sciencemag.org/cgi/content/full/325/5945/1206-b

Response to Comments on "Energy Uptake and Allocation During Ontogeny"

W. Zuo et al.

full text at www.sciencemag.org/cgi/content/full/325/5945/1206-c

SCIENCENOW

www.sciencenow.org

Highlights From Our Daily News Coverage

A Breathalyzer for Cancer

Gold nanoparticles help researchers detect lung cancer in exhaled air.

Tiny Laser Could Light the Way to New Microchip Technology

By amplifying electronic waves instead of light waves, a novel device wriggles around the size limit for conventional lasers.

Don't Stand So Close to Me

The brain's fear center gives us our sense of personal space.

SCIENCE SIGNALING

www.sciencesignaling.org

The Signal Transduction Knowledge Environment

RESEARCH ARTICLE: IL-1 Induces IGF-Dependent Epithelial Proliferation in Prostate Development and Reactive Hyperplasia

T. J. Jerde and W. Bushman

A classically inflammatory mediator, interleukin-1, also functions during development in the prostate.

PERSPECTIVE: Tumor Suppression by LKB1—SIK-ness Prevents Metastasis

R. J. Shaw

Salt-inducible kinase 1 is activated by LKB1 to promote anoikis, thereby blocking metastasis.

REVIEW: Stress at the Synapse—Signal Transduction Mechanisms of Adrenal Steroids at Neuronal Membranes

E. M. Prager and L. R. Johnson

Adrenal steroids regulate neuronal excitability by altering ion channel conductance or gene transcription.

PROTOCOL: Analysis of Signaling Events by Dynamic Phosphoflow Cytometry

G. Firaguary and J. A. Nunes

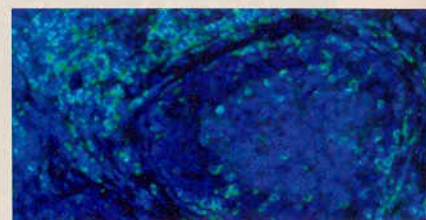
State-specific antibodies combined with flow cytometry detect the activity of signaling pathways.

NETWATCH: Gene Expression Omnibus (GEO)

Access results from thousands of experiments in a public repository of data sets from high-throughput assays; in Bioinformatics Resources.

NETWATCH: Online Mendelian Inheritance in Man (OMIM)

Explore the connections between genotype and phenotype for inherited human disorders; in Bioinformatics Resources.



SCIENCE SIGNALING
T cells in an inflamed prostate.

SCIENCE CAREERS

www.sciencereers.org/career_magazine
Free Career Resources for Scientists

Mind Matters: A Low-Stress Semester

I. S. Levine

September brings inevitable but manageable stress for academic scientists.

Taken for Granted: A 'Natural' Step?

B. L. Brenderly

Postdocs join their bosses' union at Rutgers University.

Choosing the Less Traveled Road

E. Pain

Molecular biologist Lars Jansen owes his success to not taking the easy path.

SCIENCEPODCAST

www.sciencemag.org/multimedia/podcast
Free Weekly Show

Download the 4 September Science Podcast to hear about promoting public cooperation, cooperation's origins, convergent social evolution between humans and dogs, and more.

ORIGINSBLOG

blogs.sciencemag.org/origins
A History of Beginnings

SCIENCEINSIDER

blogs.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 © 2009 by the American Association for the Advancement of Science. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (\$1 issues): \$146 (\$74 allocated to subscription). Domestic institutional subscription (\$1 issues): \$835; 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 \$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.



ADVANCING SCIENCE. SERVING SOCIETY.