

EDITORIAL

- 1042 Governance of Both Poles
Albert Grimaldi

NEWS OF THE WEEK

- 1046 Yes, There's Ice on the Moon—
But How Much, and What Use Is It?
- 1046 Belt-Tightening Could Claim
Some Scientific Scalps
- 1047 Galactic Glare Reveals Birthplace
of Cosmic Rays
>> Report p. 1080
- 1048 Splitting the Difference Between
Oil Pessimists and Optimists
- 1049 Clean Pigs Offer Alternative
to Stem Cell Transplants
- 1049 From *Science's* Online Daily News Site
- 1050 University Head Zhu Qingshi
Challenges Old Academic Ways
- 1051 Research Centers Promise a Break on
Medical Patents in Developing Countries
- 1051 From the *Science* Policy Blog

NEWS FOCUS

- 1052 Eco-Alchemy in Alberta
>> Science Podcast
- 1056 Better Homes and Hearths,
Neandertal-Style
Did Neandertals Dine In?
- 1058 Ninth International Plant
Molecular Biology Congress
Chloroplast Shuffle
Steak With a Side of Beta-Glucans
A Question of Balance

LETTERS

- 1060 Getting His Goat
S. Levay
Cell Therapy Ahead for
Parkinson's Disease
O. Isacson

Environmental Markets:
Concentrate on Criteria
T. Wu and Y.-S. Kim
Environmental Markets:
The Power of Regulation
A. Riggsbee and M. W. Doyle
Response
M. A. Palmer and S. Filoso
Training Scientists to Manage
M. Town

1062 CORRECTIONS AND CLARIFICATIONS

BOOKS ET AL.

- 1063 The Age of Empathy
F. de Waal, reviewed by J. J. Bolhuis
- 1063 The Mathematics of Sex
S. J. Ceci and W. M. Williams,
reviewed by R. T. Miller

POLICY FORUM

- 1065 New Science for Chemicals Policy
M. R. Schwarzman and M. P. Wilson

PERSPECTIVES

- 1067 Monitoring Earth's Critical Zone
D. deB. Richter Jr. and M. L. Mobley
- 1068 The Hotter the Engine, the Better
J. H. Perepezko
- 1070 Hydrate Molecular Ballet
P. G. Debenedetti and S. Sarupria
>> Report p. 1095
- 1071 Solving the Maze
C. Feuillet and K. Eversole
>> Brevia p. 1078; Reports pp. 1112, 1115,
and 1118
- 1072 Megafaunal Decline and Fall
C. Johnson
>> Report p. 1100

REVIEW

- 1074 Controlling the Velocity of Light Pulses
R. W. Boyd and D. J. Gauthier

CONTENTS continued >>



page 1052



page 1063



COVER

An ear of *Zea mays* (maize) shows color variation among kernels. Maize is one of the most important crop species worldwide, a vital source of food and fuel, and a valuable model organism for genetic research. Reports starting on pages 1112 and 1115 describe the genome sequences of the B73 and Palomero Toluqueño varieties. See also the related Report (p. 1118), Brevia (p. 1078), and Perspective (p. 1071).

Photo: *Kate Mathis/Getty Images*

DEPARTMENTS

- 1040 This Week in *Science*
1043 Editors' Choice
1044 *Science* Staff
1045 Random Samples
1131 New Products
1132 *Science* Careers

BREVIA

1078 The Palomero Genome Suggests Metal Effects on Domestication

J.-P. Vielle-Calzada et al.

Genes involved in metal tolerance likely played a role in maize domestication.

>> *Perspective p. 1071; Reports pp. 1112, 1115, and 1118*

1079 Strengthening Individual Memories by Reactivating Them During Sleep

J. D. Rudoy et al.

During sleep, memories can be influenced in a specific and systematic manner.

>> *Science Podcast*

REPORTS

1080 Detection of Gamma Rays from a Starburst Galaxy

F. Acero et al.

Detection of our nearest starburst galaxy at very high energies confirms this galaxy type as a new class of gamma-ray emitter.

>> *News story p. 1047*

1083 Shape-Controlled Colloidal Interactions in Nematic Liquid Crystals

C. P. Lapointe et al.

Polygons dispersed in a liquid crystal solvent form either dipolar or quadrupolar interactions, thus driving self-assembly.

1086 Atmospheric Sulfur in Archean Komatiite-Hosted Nickel Deposits

A. Bekker et al.

The source of sulfur in economic iron-nickel sulfide deposits is primarily derived from the atmosphere.

1089 Geophysical Detection of Relict Metasomatism from an Archean (~3.5 Ga) Subduction Zone

C.-W. Chen et al.

Seismic profiles of the Slave craton in Canada suggest that subduction is responsible for its formation.

1091 Nanoplasmonic Probes of Catalytic Reactions

E. M. Larsson et al.

Reactant concentrations can be measured as plasmon frequency shifts for model catalysts grown on nanoscale gold disks.

1095 Microsecond Simulations of Spontaneous Methane Hydrate Nucleation and Growth

M. R. Walsh et al.

An extended simulation uncovers the intricate steps whereby methane can be trapped in ice.

>> *Perspective p. 1070*

1098 Aragonite Undersaturation in the Arctic Ocean: Effects of Ocean Acidification and Sea Ice Melt

M. Yamamoto-Kawai et al.

Surface waters in the Canada Basin were undersaturated with respect to aragonite in 2008, earlier than predicted.

1100 Pleistocene Megafaunal Collapse, Novel Plant Communities, and Enhanced Fire Regimes in North America

J. L. Gill et al.

The decline in Pleistocene megafauna led to the formation of novel plant communities and increased fire.

>> *Perspective p. 1072; Science Podcast*

1103 High Symbiont Relatedness Stabilizes Mutualistic Cooperation in Fungus-Growing Termites

D. K. Aanen et al.

In symbioses of independently reproducing partners, a genetically uniform population of symbionts excludes cheating variants.

1106 Epicontinental Seas Versus Open-Ocean Settings: The Kinetics of Mass Extinction and Origination

A. I. Miller and M. Foote

Three major mass extinctions affected organisms inhabiting open-ocean-facing coasts much more so than those inhabiting shallow seas.

1109 A Periplasmic Reducing System Protects Single Cysteine Residues from Oxidation

M. Depuydt et al.

A thioredoxin-like enzyme controls the oxidation state of the bacterial periplasm.

1112 The B73 Maize Genome: Complexity, Diversity, and Dynamics

P. S. Schnable et al.

The sequence of the maize genome reveals it to be the most complex genome known to date.

>> *Perspective p. 1071; Brevia p. 1078*

1115 A First-Generation Haplotype Map of Maize

M. A. Gore et al.

In maize, recombination in the genome has been a limiting factor affecting evolution and breeding efforts.

>> *Perspective p. 1071; Brevia p. 1078*

1118 Paternal Dominance of Trans-eQTL Influences Gene Expression Patterns in Maize Hybrids

R. A. Swanson-Wagner et al.

Gene expression variation in maize hybrids is influenced by distant DNA sequences subject to paternal genomic imprinting.

>> *Perspective p. 1071; Brevia p. 1078*

1120 Symbiotic Nitrogen Fixation in the Fungus Gardens of Leaf-Cutter Ants

A. A. Pinto-Tomás et al.

Leaf-cutting ants engage in a mutualism with nitrogen-fixing bacteria that help fertilize their fungus gardens.

1123 Structural Basis of Immune Evasion at the Site of CD4 Attachment on HIV-1 gp120

L. Chen et al.

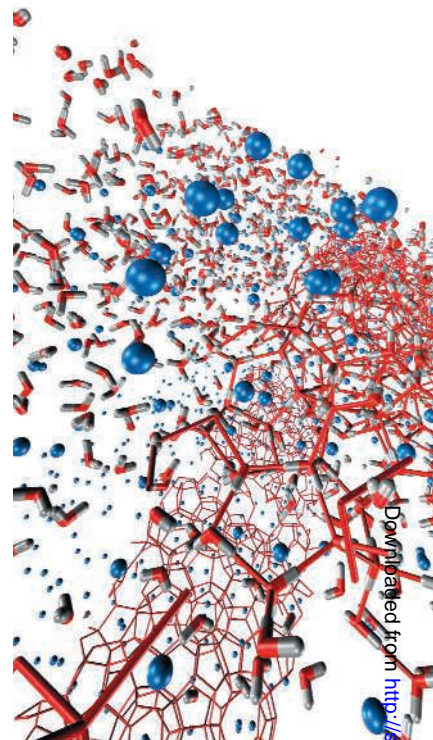
Conformational variability in an HIV coat protein complicates the therapeutic targeting of HIV-1.

1127 The Schizophrenia Susceptibility Gene *dysbindin* Controls Synaptic Homeostasis

D. K. Dickman and G. W. Davis

The dysbindin protein is required for the modulation of presynaptic neurotransmitter release in *Drosophila*.

CONTENTS continued >>>



pages 1070 & 1095



page 1103

SCIENCEONLINE

SCIENCEEXPRESS

www.scienceexpress.org

Phosphorylation of H2A by Bub1 Prevents Chromosomal Instability Through Localizing Shugoshin

S. A. Kawashima et al.

Phosphorylation of the chromatin protein histone H2A plays a critical role in chromosome segregation during cell division.

10.1126/science.1180189

Overexpression of Alpha2A-Adrenergic Receptors Contributes to Type 2 Diabetes

A. H. Rosengren et al.

Sequence variations in an adrenergic receptor gene cause reduced insulin secretion and contribute to type 2 diabetes.

10.1126/science.1176827

Gigahertz Dynamics of a Strongly Driven Single Quantum Spin

G. D. Fuchs et al.

Fast spin-flips are observed in the nitrogen vacancy centers in diamond.

10.1126/science.1181193

Universality in Three- and Four-Body Bound States of Ultracold Atoms

S. E. Pollack et al.

The interactions involved in the formation of few-body bound states can be probed in a cloud of ultracold atoms.

10.1126/science.1182840

Direct Imaging of Bridged Twin Protoplanetary Disks in a Young Multiple Star

S. Mayama et al.

An infrared image taken with the Subaru Telescope reveals young binary stars and their circumstellar environments.

10.1126/science.1179679

SCIENCENOW

www.sciencenow.org

Highlights From Our Daily News Coverage

Meditation Halves Risk of Heart Attack

A relaxation technique may be as powerful as modern drugs.

A Silent Killer in Bangladesh Wells

Researchers discover the cause of arsenic contamination in the country's aquifers.

Socially Awkward? Check Your Genes

Researchers link a single genetic difference to the ability to read others' emotions.

SCIENCE SIGNALING

www.sciencesignaling.org

The Signal Transduction Knowledge Environment

RESEARCH ARTICLE: *Trypanosoma cruzi* Targets Akt in Host Cells as an Intracellular Anti-Apoptotic Strategy

M. V. Chuenkova and M. PereiraPerrin

A surface protein of the intracellular parasite *T. cruzi* directly interacts with Akt to protect infected cells from pro-apoptotic stimuli.

RESEARCH ARTICLE: Tyrosine Phosphorylation Inhibits PKM2 to Promote the Warburg Effect and Tumor Growth

T. Hitosugi et al.

PERSPECTIVE: PKM2 Tyrosine Phosphorylation and Glutamine Metabolism Signal a Different View of the Warburg Effect

C. V. Dang

Aerobic glycolysis in cancer cells is associated with tyrosine phosphorylation of a metabolic enzyme.

PERSPECTIVE: Acetylation Goes Global—The Emergence of Acetylation Biology

K. L. Norris et al.

Proteomic analysis shows protein acetylation to be more prevalent than previously appreciated.

GLOSSARY

Discover what TRPA, GJIC, and miR mean in the world of signaling.

SCIENCE CAREERS

www.sciencecareers.org/career_magazine

Free Career Resources for Scientists

Audacity, Part 3: Funding

A. Sasso

What are the best strategies for funding high-risk, high-reward research?

Tooling Up: The Project Management Career Track

D. Jensen

Project management, as a career and a skill, requires detail management, good communication, and people skills.

The New Science Careers Communities

Science Careers Staff

Expand your professional network in MySciNet, a community for scientists from diverse backgrounds, and CTSciNet, the Clinical and Translational Science Network.

SCIENCE TRANSLATIONAL MEDICINE

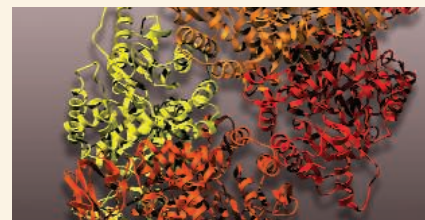
www.sciencetranslationalmedicine.org

Integrating Medicine and Science

PERSPECTIVE: Researching Genetic Versus Nongenetic Determinants of Disease—A Comparison and Proposed Unification

J. Ioannidis et al.

Studies are needed that concurrently measure genotypes, nongenetic exposures, and outcomes.



SCIENCE SIGNALING

Pyruvate kinase M2 in tumor metabolism.

RESEARCH ARTICLE: Frequent Release of Low Amounts of Herpes Simplex Virus from Neurons—Results of a Mathematical Model

J. T. Schiffer et al.

A stochastic mathematical model elucidates constitutive herpes simplex virus 2 release in the genital tract in infected individuals.

RESEARCH ARTICLE: Restoration of Norepinephrine-Modulated Contextual Memory in a Mouse Model of Down Syndrome

A. Salehi et al.

PERSPECTIVE: Cognitive Enhancement Therapy for a Model of Down Syndrome

F. K. Wiseman

Cognitive deficits in mice can be reversed with precursors to the neurotransmitter norepinephrine.

SCIENCE PODCAST

www.sciencemag.org/multimedia/podcast

Free Weekly Show

Download the 20 November *Science* Podcast to hear about the demise of Pleistocene megafauna, strengthening memories during sleep, cleaning up tar sands, and more.

ORIGINS BLOG

blogs.sciencemag.org/origins

A History of Beginnings

SCIENCE INSIDER

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 (51 issues): \$146 (\$74 allocated to subscription). Domestic institutional subscription (51 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

Science

326 (5956)

Science **326** (5956), 1040-1131.

ARTICLE TOOLS

<http://science.sciencemag.org/content/326/5956>

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 © 2009 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works.