

## EDITORIAL

- 547 Irreverence and Indian Science  
*R. A. Mashelkar*

## NEWS OF THE WEEK

- 554 Survey to Reveal True Face of Chinese Society
- 555 Frog DNA Yields Clues to Vertebrate Genome Evolution  
>> *Report p. 633*
- 557 Deal to Legalize Whaling Would Sideline Science
- 558 DNA Returned to Tribe, Raising Questions About Consent
- 559 Race to Contain Plague in Quake Zone
- 559 From *Science's* Online Daily News Site
- 560 Iran Faculty Dismissals Seen as Result of New Policy
- 560 Paul Nurse Chosen to Head Royal Society
- 561 Redesign Postpones Launch of Long-Delayed Space Station Experiment
- 561 From the *Science* Policy Blog

## NEWS FOCUS

- 562 Beyond Clotting: The Powers of Platelets
- 565 Spunky Hayabusa Heads Home With Possible Payload  
>> *Science Podcast*
- 566 Society for American Archaeology 75th Anniversary Meeting  
Uncovering a Rural Chinese Pompeii  
The Long Reach of the Monsoon  
Playing Politics or Just a Game?

## LETTERS

- 568 Food Security: Farming Insects  
*G. W. Sileshi and M. Kenis*
- MRI Safety Not Scientifically Proven  
*F. S. Prato et al.*

Fundamental Change in German Research Policy  
*C.-C. Carbon*

Measuring Forest Changes  
*W. F. Laurance and O. Venter*

## 569 CORRECTIONS AND CLARIFICATIONS

## BOOKS ET AL.

- 570 Technological Medicine  
*S. J. Reiser, reviewed by R. S. Mathis*
- 571 Taming the Beloved Beast  
*D. Callahan, reviewed by B. L. Benderly*
- 571 BROWSINGS

## POLICY FORUM

- 572 Fifty Years of U.S. Embargo: Cuba's Health Outcomes and Lessons  
*P. K. Drain and M. Barry*

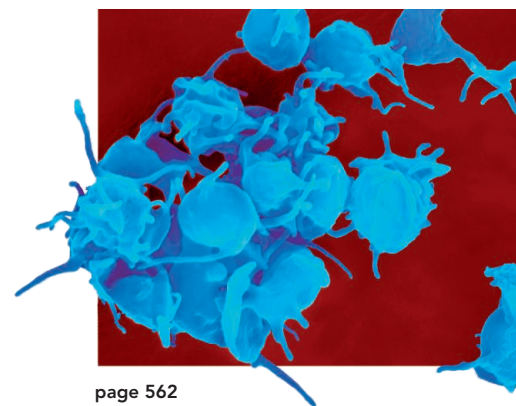
## PERSPECTIVES

- 574 A Fungal Past to Insect Color  
*T. Fukatsu*  
>> *Report p. 624*
- 575 Matters of Scale  
*B. J. McGill*
- 576 Hidden Growth of Supermassive Black Holes in Galaxy Mergers  
*J. Primack*  
>> *Report p. 600*
- 578 Cooperation and Punishment  
*L. Putterman*  
>> *Reports pp. 613 and 617*
- 579 Chimpanzee Technology  
*W. C. McGrew*
- 581 Biological Systems Theory  
*J. Gunawardena*
- 582 The Road Ahead for Metamaterials  
*N. I. Zheludev*

## SCIENCE PRIZE ESSAY

- 584 The ChemCollective—Virtual Labs for Introductory Chemistry Courses  
*D. Yaron et al.*

**CONTENTS** continued >>



page 562



page 571



## COVER

A late-stage *Xenopus tropicalis* (western clawed frog) tadpole, about 5 centimeters in length, with emerging hindlimbs. Through the skin of the head, the optic, trigeminal, and olfactory nerves, as well as the paired thymus and large blood vessels, are visible. A Report on page 633 describes the genome of this organism, which is an important model for vertebrate development.

*Photo: Siwei Zhang, Jingjing Li, Enrique Amaya*

## DEPARTMENTS

- 543 This Week in *Science*
- 548 Editors' Choice
- 550 *Science* Staff
- 553 Random Samples
- 586 AAAS News & Notes
- 640 New Products
- 641 *Science* Careers

Downloaded from www.sciencemag.org on May 23, 2018

## REVIEW

- 587 **The Origins of  $C_4$  Grasslands: Integrating Evolutionary and Ecosystem Science**  
*C<sub>4</sub> Grasses Consortium*

## BREVIA

- 592 **Mutations in *DCC* Cause Congenital Mirror Movements**  
*M. Srouf et al.*  
Humans who display involuntary symmetrical limb movements carry mutations in a gene required for nerve growth across the midline.

## RESEARCH ARTICLE

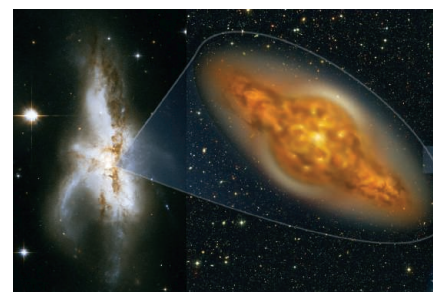
- 593 **Systematic Analysis of Human Protein Complexes Identifies Chromosome Segregation Proteins**  
*J. R. A. Hutchins et al.*  
A strategy designed to decipher the function of proteins identified in RNA interference screens reveals new insights into mitosis.

## REPORTS

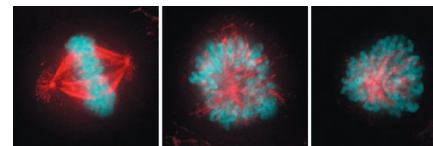
- 600 **Major Galaxy Mergers and the Growth of Supermassive Black Holes in Quasars**  
*E. Treister et al.*  
Obscured and unobscured quasars represent two sequential phases of gas-rich mergers of massive galaxies.  
>> *Perspective p. 576*
- 602 **Conversion of Sugars to Lactic Acid Derivatives Using Heterogeneous Zeotype Catalysts**  
*M. S. Holm et al.*  
Lewis acid catalysis offers an alternative to fermentation in converting sugars to a commercial chemical feedstock.
- 605 **Recent Hotspot Volcanism on Venus from VIRTIS Emissivity Data**  
*S. E. Smrekar et al.*  
Satellite observations suggest that Venus is a geologically active planet.
- 608 **Cryogenian Glaciation and the Onset of Carbon-Isotope Decoupling**  
*N. L. Swanson-Hysell et al.*  
A large oceanic organic carbon reservoir developed in the period between two global glaciations.
- 611 **Asian Monsoon Transport of Pollution to the Stratosphere**  
*W. J. Randel et al.*  
Satellite observations of atmospheric hydrogen cyanide reveal that the Asian monsoon transports air deep into the stratosphere.

- 613 **Lab Experiments for the Study of Social-Ecological Systems**  
*M. A. Janssen et al.*  
>> *Science Podcast*
- 617 **Coordinated Punishment of Defectors Sustains Cooperation and Can Proliferate When Rare**  
*R. Boyd et al.*  
Communication and coordination are essential components in cooperative endeavors.  
>> *Perspective p. 578*
- 620 **Maternal Control of Haplodiploid Sex Determination in the Wasp *Nasonia***  
*E. C. Verhulst et al.*  
Femaleness in a parasitoid wasp, unlike in bees, requires male and female input, explaining why diploids are female.
- 624 **Lateral Transfer of Genes from Fungi Underlies Carotenoid Production in Aphids**  
*N. A. Moran and T. Jarvik*  
An unusual case of ancestral transfer of pigment genes from a fungus confers a functionally specific trait in an animal.  
>> *Perspective p. 574*
- 627 **D-Amino Acids Trigger Biofilm Disassembly**  
*I. Kolodkin-Gal et al.*  
Bacteria secrete an unusual form of amino acids to escape from aging communities by dissolving the surrounding matrix.
- 630 **Light-Induced Structural Changes in a Photosynthetic Reaction Center Caught by Laue Diffraction**  
*A. B. Wöhri et al.*  
Fleeting molecular events are observed as light illuminates chlorophyll to initiate photosynthesis.
- 633 **The Genome of the Western Clawed Frog *Xenopus tropicalis***  
*U. Hellsten et al.*  
Assembly, annotation, and analysis of the frog genome compares gene content and synteny with the human and chicken genomes.  
>> *News story p. 555*
- 636 **Analysis of Genetic Inheritance in a Family Quartet by Whole-Genome Sequencing**  
*J. C. Roach et al.*  
Genomic sequencing of an entire family reveals the rate of spontaneous mutations in humans and identifies disease genes.

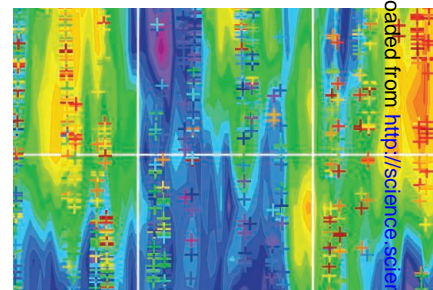
**CONTENTS** continued >>



pages 576 & 600



page 593



page 611

## SCIENCEONLINE

## SCIENCEEXPRESS

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

**Global Biodiversity: Indicators of Recent Declines**  
S. H. M. Butchart et al.

An analysis of 30 indicators shows that the Convention on Biological Diversity's 2010 reduction targets have not been met.  
10.1126/science.1187512

**Endosomal Chloride-Proton Exchange Rather Than Chloride Conductance Is Crucial for Renal Endocytosis**

G. Novarino et al.  
10.1126/science.1188070

**Lysosomal Pathology and Osteopetrosis upon Loss of H<sup>+</sup>-Driven Lysosomal Cl<sup>-</sup> Accumulation**  
S. Weinert et al.

Chloride conductance and chloride-proton exchange on endolysosomal physiology are compared in two mouse models.  
10.1126/science.1188072

**Self-Assembled M<sub>24</sub>L<sub>48</sub> Polyhedra and Their Sharp Structural Switch upon Subtle Ligand Variation**

Q.-F. Sun et al.  
A slight change in ligand geometry determines whether a 12- or 24-vertex polyhedron will form.  
10.1126/science.1188605

**Freshwater Outburst from Lake Superior as a Trigger for the Cold Event 9300 Years Ago**  
S.-Y. Yu et al.

The trigger for the dramatic North Atlantic cooling event 9300 years ago was an outburst flood from Lake Superior.  
10.1126/science.1187860

## SCIENCENOW

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

Highlights From Our Daily News Coverage

**Chimps Grieve Over Dead Relatives**

Two studies document an almost humanlike response to death.

**Dark Matter Halos Look a Bit Like a Football**

Clumps of the mysterious substance reveal surprisingly similar shapes.

**Elephants Have an Alarm Call for Bees**

Study suggests that pachyderms tailor vocal warnings to specific foes.

## SCIENCE SIGNALING

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

The Signal Transduction Knowledge Environment

**RESEARCH ARTICLE: Ammonia Derived from Glutaminolysis Is a Diffusible Regulator of Autophagy**

C. H. Eng et al.  
A volatile metabolic by-product can promote cell survival through the induction of autophagy.

**RESEARCH ARTICLE: SUMOylation of the Transcriptional Co-Repressor KAP1 Is Regulated by the Serine and Threonine Phosphatase PP1**  
X. Li et al.

Two isoforms of protein phosphatase 1 coordinate the recovery of cells from genotoxic stress.

**RESEARCH ARTICLE: Evolution of CASK into a Mg<sup>2+</sup>-Sensitive Kinase**  
K. Mukherjee et al.

The atypical kinase CASK evolved from a conventional Mg<sup>2+</sup>-dependent kinase.

**EDITORIAL GUIDE: Teaching Tools and Learning Opportunities**

N. R. Gough  
*Science Signaling* provides authoring experience for students and resources for educators.

**JOURNAL CLUB: Costimulatory Role of CXCR4 with Pre-TCR and Its Crosstalk with PI3K in  $\beta$ -Selection of Thymocytes**

J. A. Ahamed and P. Madhivadhani  
Chemokine and pre-TCR signaling cooperate in  $\beta$ -selection of thymocytes and promote their subsequent proliferation.

**JOURNAL CLUB: New Regulator for Energy Signaling Pathway in Plants Highlights Conservation Among Species**

A. K. Meyer et al.  
The kinase CIKP links plant pathways involved in oxygen-sensing and carbohydrate metabolism.

**TEACHING RESOURCES: Animations of Canonical Signaling Pathways**

J. D. Thatcher  
Four pairs of animations provide tools for introducing core signaling pathways and a way for students to test their knowledge.

## SCIENCE CAREERS

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

Free Career Resources for Scientists

**Mind Matters: Back to Work After Baby, Part 2**  
I. S. Levine

New mothers can minimize stress and maximize productivity by adapting to their circumstances.

**Navigating Historic Changes**

N. Lubick  
A sense of humor, hard work, and daring helped microbiologist Ingrid Grummt achieve success.

**Science Careers Communities**  
*Science Careers Staff*

Connect with scientists from diverse backgrounds in MySciNet or with clinical and translational scientists in CTSiNet.

## SCIENCE TRANSLATIONAL MEDICINE

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

Integrating Medicine and Science

**COMMENTARY: Six Questions About Translational Due Diligence**

E. Selinger  
To maintain public support, the translational research enterprise must do more than provide results.

**RESEARCH ARTICLE: Cystic Fibrosis Pigs Develop Lung Disease and Exhibit Defective Bacterial Eradication at Birth**

D. A. Stoltz et al.  
**PERSPECTIVE: The Development of Lung Disease in Cystic Fibrosis Pigs**  
J. J. Wine

The lungs of piglets with CF fail to efficiently eliminate bacteria, suggesting that lung problems in CF patients may be secondary to impaired antibacterial defense.

**RESEARCH ARTICLE: Wnt Proteins Promote Bone Regeneration**

S. Minear et al.  
A liposome-encased ligand for the Wnt signaling pathway can accelerate bone regeneration after injury.

## SCIENCE PODCAST

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

Download the 30 April *Science* Podcast to hear about lab experiments of a dynamic social-ecological system, the return of Japan's Hayabusa asteroid mission, your letters to *Science*, and more.

## 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 © 2010 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): \$910; 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

**328 (5978)**

*Science* **328** (5978), 543-640.

**ARTICLE TOOLS**

<http://science.sciencemag.org/content/328/5978>

**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. 2017 © The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. The title *Science* is a registered trademark of AAAS.