

SPECIAL SECTION

Speciation

INTRODUCTION

727 Happy Birthday, Mr. Darwin

REVIEWS

728 The Red Queen and the Court Jester: Species Diversity and the Role of Biotic and Abiotic Factors Through Time
M. J. Benton

732 Adaptive Radiation: Contrasting Theory with Data
S. Gavrillets and J. B. Losos

737 Evidence for Ecological Speciation and Its Alternative
D. Schluter

741 The Bacterial Species Challenge: Making Sense of Genetic and Ecological Diversity
C. Fraser et al.

746 Is Genetic Evolution Predictable?
D. L. Stern and V. Orgogozo

>> For a list of all related content, see p. 727 or go to www.sciencemag.org/darwin/

EDITORIAL

687 Species Uncertainties
Robert M. May and Paul H. Harvey
>> Speciation section p. 727

NEWS OF THE WEEK

- 696 Agencies Sweat the Details of Spending Billions More on Science
- 697 New Ph.D.s to Teach Harvard Undergrads
- 698 California Researchers Chilled by Sudden Freeze on Bond Funds
Stem Cell Institute Looks for New Ways to Raise Cash
- 699 Life Scientists Cautious About Dual-Use Research, Study Finds

- 700 Some Neglected Diseases Are More Neglected Than Others
- 701 Invisibility Umbrella Would Let Future Harry Potters See the Light
- 701 From the *Science* Policy Blog

NEWS FOCUS

- 702 Polio: Looking for a Little Luck
Rethinking the Polio Endgame
- 706 Evolutionary Biology: Agreeing to Disagree
>> Speciation section p. 727
- 709 ORIGINS
On the Origin of Art and Symbolism
>> Speciation section p. 727; Science Podcast

LETTERS

- 713 Keeping Raw Data in Context
I. Sim et al.
The IRB Is Key
W. R. Lovallo
Response
J. A. List
Implications of Ancient Ice
S. Zimov
Response
D. G. Froese et al.
- 714 CORRECTIONS AND CLARIFICATIONS
- 714 TECHNICAL COMMENT ABSTRACTS

BOOKS ET AL.

- 716 Why Evolution Is True
J. A. Coyne, reviewed by M. Pigliucci
- 717 Perspectives in Animal Phylogeny and Evolution
A. Minelli, reviewed by W. Arthur

POLICY FORUM

- 718 Biologically Reversible Exploration
C. P. McKay



page 709

PERSPECTIVES

- 719 Forming Massive Stars
B. Whitney
>> Report p. 754
- 720 Time's Stamp on Modern Biogeography
J. A. Crame
>> Report p. 767
- 721 Computational Social Science
D. Lazer et al.
- 723 Moonlighting in Mitochondria
M. G. Myers Jr.
>> Report p. 793
- 724 Heavy Metals or Punk Rocks?
R. J. Bodnar
>> Report p. 764
- 725 Confined Polymers Crystallize
P. J. Lemstra
>> Report p. 757

CONTENTS continued >>



COVER

Charles Darwin's abiding interest in the classification of barnacles, illustrated here, was one of the inspirations for his investigations into the origins and diversification of species. *Science* marks Darwin's 200th birthday with a special section on speciation beginning on page 727.

Image: Illustrations by George Sowerby, reproduced with permission from *The Complete Work of Charles Darwin Online*, John van Wyhe, Ed. (<http://darwin-online.org.uk>); background: iStockphoto.com

DEPARTMENTS

- 683 This Week in *Science*
- 688 Editors' Choice
- 690 *Science* Staff
- 693 Random Samples
- 695 Newsmakers
- 807 Information for Contributors
- 809 New Products
- 810 *Science* Careers

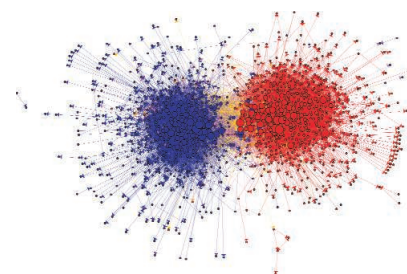
BREVIA

- 753 **The Sea-Level Fingerprint of West Antarctic Collapse**
J. X. Mitrovica et al.
 An uneven pattern of local sea-level rise would result from the collapse of the West Antarctic Ice Sheet.

REPORTS

- 754 **The Formation of Massive Star Systems by Accretion**
M. R. Krumholz et al.
 Numerical simulations show that instabilities can channel gas into growing massive stars despite their high radiation pressure.
 >> *Perspective p. 719*
- 757 **Confined Crystallization of Polyethylene Oxide in Nanolayer Assemblies**
H. Wang et al.
 Squeezing ultrathin polymer layers can induce crystallization and decrease their gas permeability.
 >> *Perspective p. 725*
- 760 **Nitrogen-Doped Carbon Nanotube Arrays with High Electrocatalytic Activity for Oxygen Reduction**
K. Gong et al.
 Carbon atoms in nanotubes are activated by nitrogen doping and catalyze oxygen reduction at high pH.
- 764 **Anomalously Metal-Rich Fluids Form Hydrothermal Ore Deposits**
J. J. Wilkinson et al.
 The metal contents of the fluid inclusions that create lead-zinc ores have been drastically underestimated.
 >> *Perspective p. 724*
- 767 **Signature of the End-Cretaceous Mass Extinction in the Modern Biota**
A. Z. Krug et al.
 Increased rates of marine bivalve speciation after the Cretaceous-Tertiary extinction were most marked in the tropics.
 >> *Perspective p. 720*
- 771 **A Great-Appendage Arthropod with a Radial Mouth from the Lower Devonian Hunsrück Slate, Germany**
G. Kühl et al.
 Fossil evidence for the great-appendage arthropods extends to more recent periods by about 100 million years.
- 773 **Two Thresholds, Three Male Forms Result in Facultative Male Trimorphism in Beetles**
J. M. Rowland and D. J. Emlen
 A clade of dung beetles can alter their reproductive tactics by switching between three male forms.

- 776 **Sequential Sympatric Speciation Across Trophic Levels**
A. A. Forbes et al.
 A host shift by a fly is causing its wasp parasite to undergo changes leading to speciation.
- 779 **Evolution of the *Drosophila* Nuclear Pore Complex Results in Multiple Hybrid Incompatibilities**
S. Tang and D. C. Presgraves
 Nuclear pore complex proteins are involved in lethal gene interactions in *Drosophila melanogaster*–*D. simulans* species hybrids.
- 782 **Queen Ants Make Distinctive Sounds That Are Mimicked by a Butterfly Social Parasite**
F. Barbero et al.
 Sounds made by queen ants denoting rank are copied by the larvae and pupae of a parasitic butterfly, facilitating their infiltration into ant colonies.
- 785 **Stability Predicts Genetic Diversity in the Brazilian Atlantic Forest Hotspot**
A. C. Carnaval et al.
 Modeling ecological niches under past climates establishes a method to improve prediction and protection of tropical biodiversity hotspots.
- 789 **Orc1 Controls Centriole and Centrosome Copy Number in Human Cells**
A. S. Hemerly et al.
 A DNA replication factor ensures that only two centrioles are formed during cell division in animal cells.
- 793 **Function of Mitochondrial Stat3 in Cellular Respiration**
J. Wegryzn et al.
 A protein that has a nuclear function as a transcription factor also functions to support respiration in the mitochondria.
 >> *Perspective p. 723*
- 797 **Platelets Kill Intraerythrocytic Malarial Parasites and Mediate Survival to Infection**
B. J. McMorran et al.
 Mouse and human platelets bind malarial-infected red cells and kill the parasite within.
- 800 **Changes in Cortical Dopamine D1 Receptor Binding Associated with Cognitive Training**
F. McNab et al.
 Training of working memory alters brain biochemistry by changing the density of cortical dopamine receptors.
 >> *Science Podcast*
- 802 **Axon Regeneration Requires a Conserved MAP Kinase Pathway**
M. Hammarlund et al.
 Axon regeneration in adult nematode worms has distinct signals that are independent of earlier developmental programs.



page 721



page 737



page 771

CONTENTS continued >>

SCIENCEONLINE

SCIENCEEXPRESS

www.scienceexpress.org

Molecular and Evolutionary History of Melanism in North American Gray Wolves

T. M. Anderson et al.

Black coat color in wolves derives from a mutation that originated in domestic dogs.

10.1126/science.1165448

>> [Science Podcast](#)

Blue or Red? Exploring the Effect of Color on Cognitive Task Performances

R. Mehta and R. Zhu

Blue favors creativity in humans, whereas red improves attention to detail.

10.1126/science.1169144

Dynamic Order-Disorder in Atomistic Models of Structural Glass Formers

L. O. Hedges et al.

The liquid-to-glass transition of a simple mixture is controlled by parameters that drive the system away from equilibrium.

10.1126/science.1166665

Implications of a VLBI Distance to the Double Pulsar J0737-3039A/B

A. T. Deller et al.

Tests of gravity theories that use this double pulsar, now recognized as being more distant, will be more precise.

10.1126/science.1167969

TECHNICALCOMMENTS

Comment on "Human-Specific Gain of Function in a Developmental Enhancer"

L. Duret and N. Galtier

full text at www.sciencemag.org/cgi/content/full/323/5915/714c

Response to Comment on "Human-Specific Gain of Function in a Developmental Enhancer"

S. Prabhakar et al.

full text at www.sciencemag.org/cgi/content/full/323/5915/714d

SCIENCENOW

www.sciencenow.org

Highlights From Our Daily News Coverage

Test Tube Babies Shed Light on Nature Versus Nurture

Children born to genetically unrelated mothers provide clues to origins of antisocial behavior.

Turtles Island-Hopped Their Way Across a Warm Arctic

Widespread volcanism and tropical temperatures helped ancient turtles migrate to America.

Titan's Methane Mystery

Scientists suspect liquid hydrocarbon reservoirs lurk beneath the Moon's surface.

SCIENCE SIGNALING

www.sciencesignaling.org

The Signal Transduction Knowledge Environment

PERSPECTIVE: Extracellular ATP in the Immune System—More Than Just a "Danger Signal"

A. Trautmann

Extracellular ATP is an important modulator of immune responses.

PERSPECTIVE: Bistable Switches for Synaptic Plasticity

H. Ogasawara and M. Kawato

Nearly a decade intervened between theoretical predictions and experimental verification of the mechanisms underlying synaptic plasticity.

PODCAST

P. P. Pandolfi and A. M. VanHook

Inactivating mTOR signaling in the adult mouse prostate decreases the incidence of cancer.

E-LETTER: Microarrays Need Phylogenetics

M. Abu-Asab

Interpreting microarray experiments might benefit from evolution-compatible analytical tools.

SCIENCE CAREERS

www.sciencereaders.org/career_magazine

Free Career Resources for Scientists

February 2009 Funding News

J. Fernández

Learn about the latest in research funding, scholarships, fellowships, and internships.

Darwin's Legacy 1: Rich Collections, Deep Expertise

S. Carpenter

Natural history museums have reasserted their scientific relevance in recent years.

Darwin's Legacy 2: Keeping Order

K. Travis

London entomology curator Erica McAlister is responsible for everything from museum collections to fieldwork.

Darwin's Legacy: Resources

Science Careers Staff

Here is a collection of resources related to careers in the *H.M.S. Beagle's* wake.

>> [Speciation section p. 727; www.sciencemag.org/darwin/](#)

SCIENCEPODCAST

www.sciencemag.org/multimedia/podcast

Free Weekly Show

Download the 6 February *Science* Podcast to hear about the biochemistry behind better short-term memory, the genetics of wolf coat color, the origin of art, and more.

ORIGINSBLOG

blogs.sciencemag.org/origins

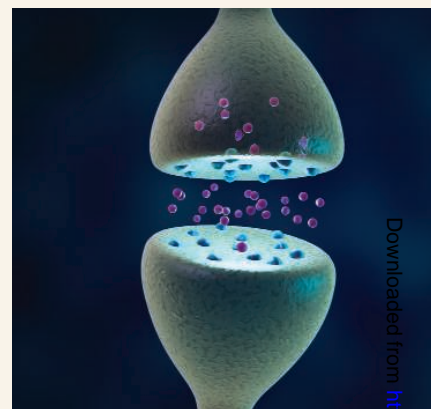
A History of Beginnings

>> [Speciation section p. 727; www.sciencemag.org/darwin/](#)

SCIENCEINSIDER

blogs.sciencemag.org/scienceinsider

Science Policy News and Analysis



SCIENCE SIGNALING

Dynamic synapses.



SCIENCE CAREERS

Career opportunities via Darwin.

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.

AAAS

ADVANCING SCIENCE. SERVING SOCIETY

Science

323 (5915)

Science **323** (5915), 683-809.

ARTICLE TOOLS

<http://science.sciencemag.org/content/323/5915>

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.