

**Mars Exhales Methane | Baby's Got Beat | Clean Skies, Warm Europe**

\$3.95 U.S. | [www.sciencenews.org](http://www.sciencenews.org)

# ScienceNews

MAGAZINE OF THE SOCIETY FOR SCIENCE & THE PUBLIC ■ FEBRUARY 14, 2009

Looking  
for  
**Love**  
in 8 minutes or less

**Extreme  
Mating  
Games**

**The Solar  
System's  
History of  
Violence**

**Quiet  
Deaths in  
Western  
Forests**

Introducing the world's simplest cell phone experience – with service as low as \$10 a month.\*

# It doesn't play games, take pictures, **NEW** **No** **Contract** or give you the weather. **Free Gift** see below

The Jitterbug® developed with Samsung®. It's the cell phone that's changing all the rules.

**For people like me, who want a cell phone that's easy to use.** Over the years, cell phones have become smaller and smaller with so many complicated features. They are harder to program and harder to use. But the Jitterbug cell phone has simplified everything, so it's not only easy to use, it's easy to try. No crowded malls, no waiting in line, no confusing sales people, or complicated plans. Affordable and convenient cell phone service is only a toll-free phone call away.

## Questions about Jitterbug?

Try our pre-recorded Jitterbug Toll-Free Hotline **1-888-809-8817**.

## The new Jitterbug cell phone makes calling simple!

- Large, bright, easy to see display and buttons
- Comes pre-programmed and ready to use right out of the box
- No contract required
- An operator is always available to help you, and will call you by name
- Push "Yes" to call directly from your personal phone list
- Soft ear cushion and louder volume for better sound quality
- Separate Volume Up/Down button on cover of phone
- Hearing aid compatible
- Familiar dial tone confirms service (no other cell phone has this)
- Service as low as \$10 a month\*
- Access help wherever you go



## Why pay for minutes you'll never use!

	Simple 30 Plan†	Simple 60 Plan†
Monthly Price	\$15	\$20
Included Minutes/Month	30	60
Operator Assistance	24/7	24/7
911 Access	FREE	FREE
Long Distance Calls	No add'l charge	No add'l charge
Nationwide Coverage††	Yes	Yes
Trial Period	30 days	30 days

Order now  
and receive a  
free Car Charger.  
**A \$24 value!**

**Service as low as \$10 a month and a friendly 30-day return policy.\*\*** If you've ever wanted the security and convenience of a cell phone, but never wanted the fancy features and minutes you don't need... Jitterbug is for you. Like me, you'll soon be telling your friends about Jitterbug. Call now.

**jitterbug®** brought  
to you by

**firstSTREET**  
for Boomers and Beyond®  
1998 Ruffin Mill Road  
Colonial Heights, VA 23834

Jitterbug Cell Phone Item# BU-4722

Call now for our lowest price.

Please mention promotional code 37729.

**1-866-681-7128**

**www.firststreetonline.com**

IMPORTANT CONSUMER INFORMATION: Subject to Customer Agreement, select calling plans, and credit approval. Other charges and restrictions may apply. Screen images simulated. Coverage and service not available everywhere. Copyright © 2009 GreatCall, Inc. Jitterbug is a registered trademark of GreatCall, Inc. Samsung is a registered trademark of Samsung Electronics America, Inc and its related entities. \*Not including government taxes, assessment surcharges, and set-up fee. \*\*Applies to phone and monthly service charges only, provided call time usage is less than 30 minutes and phone is in like-new condition. Usage charges may apply. †All plans require the purchase of a Jitterbug phone. In addition, there is a one time set up fee of \$35. ††Jitterbug will work almost everywhere in the U.S. where cellular service is available from most of the major carriers. All rights reserved. © 2007 TechnoBrands®, Inc.

# ScienceNews

## In The News

### 5 STORY ONE

- DNA methylation occurs in unexpected locales

### 8 ENVIRONMENT

- Routine tree deaths double in the warming West
- Icy Antarctica not immune to climate change

### 9 EARTH

- Pollution and fog kept Europe cool

### 10 ATOM & COSMOS

- Martian methane may signal life, or geochemistry

### 11 SCIENCE & SOCIETY

- 2009 Intel Science Talent Search finalists announced

### 12 LIFE

- Capuchins don't leave stone selection to chance
- Old estimates of Carlsbad's bats may have been far off

### 13 BODY & BRAIN

- Brain scans map activity particular to borderline personality disorder

### 14 HUMANS

- Control trumps violence for gamers
- Newborn babies may feel the downbeat

## Features

### 16 A MOST PRIVATE EVOLUTION

Sex and mating games have led to some surprising and downright bizarre forms.  
*By Susan Milius*

### 22 THE DATING GO ROUND

COVER STORY: Speed dating offers new insights into real-life romantic attraction and the start of relationships.  
*By Bruce Bower*

### 26 THE SOLAR SYSTEM'S BIG BANG

The moon's craters may help scientists fill in the details of the solar system's earliest years.  
*By Ron Cowen*

## Departments

### 2 FROM THE EDITOR

### 4 NOTEBOOK

### 30 BOOKSHELF

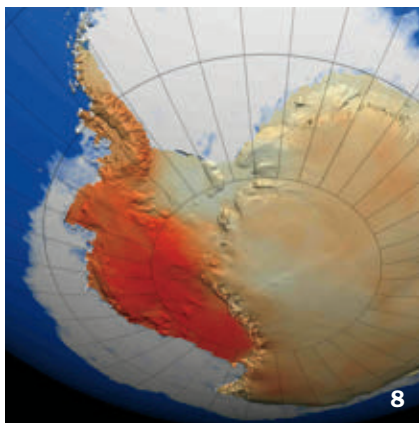
### 31 FEEDBACK

### 32 COMMENT

Lonnie Thompson explains what science loses as tropical glaciers recede.

### COVER

Psychologists are taking advantage of speed dating to study the science of romantic attraction.  
*Photograph by Cary Wolinsky*



8



12



16



26



*publisher* Elizabeth Marincola *editor in chief* Tom Siegfried

**EDITORIAL STAFF** *managing editor* Eva Emerson

*senior editor/policy* Janet Raloff

*assistant managing editor* Kristina Bartlett Brody

*news editor* Elizabeth Quill *associate editor* Emily Krieger

*astronomy* Ron Cowen

*behavioral sciences* Bruce Bower

*biomedicine* Nathan Seppa

*biotechnology* Patrick Barry

*earth sciences* Sid Perkins

*environment/chemistry* Rachel Ehrenberg

*life sciences* Susan Milius

*molecular biology*

Tina Hesman Saey

*staff writer* Laura Sanders

*web specialist/editorial secretary*

Gwendolyn K. Gillespie

**DESIGN** *design director* Bob Gray

*assistant art directors* Joshua Korenblat, Avik Nandy

**ADVERTISING | CIRCULATION** *associate publisher* Jonathan Oleisky

*advertising manager* Judy Lewis *West & Mid-Atlantic*

*circulation manager* Tosh Arimura

*account executives* Regan Pickett *Midwest & South*

Gregg Oehler, Rich Cordero *Oehler Media, Northeast*

*advertising/circulation assistant* Kerwin Wilson *permissions* Evora Swoopes

**EDITORIAL, ADVERTISING AND BUSINESS OFFICES**

1719 N Street NW, Washington, DC 20036 • Phone (202) 785-2255

*Subscriptions* subs@sciencenews.org • *Editorial/Letters* editors@sciencenews.org

*Advertising/Business* snsales@sciencenews.org

**Science News** (ISSN 0036-8423) is published biweekly, for \$54.50 for 1 year or

\$98 for 2 years (international rate \$80.50 for 1 year or \$161 for 2 years) by

Society for Science & the Public, 1719 N Street NW Washington, DC 20036.

Preferred periodicals postage paid at Washington, DC, and an additional mailing office.

**Subscription Department:** PO Box 1205, Williamsport, PA 17703-1205.

For new subscriptions and customer service, call 1-800-552-4412.

**Postmaster:** Send address changes to *Science News*, PO Box 1205, Williamsport, PA 17703-

1205. Two to four weeks' notice is required. Old and new addresses, including zip codes,

must be provided. Copyright © 2009 by Society for Science & the Public. Title registered

as trademark U.S. and Canadian Patent Offices. Printed in U.S.A. on recycled paper.



SOCIETY FOR  
SCIENCE & THE PUBLIC

**BOARD OF TRUSTEES** *chairman* Dudley Herschbach

*vice chairman* Robert W. Fri *secretary* David A. Goslin

*treasurer* Michela English *members* Deborah Blum, Jeanette Grasselli

Brown, S. James Gates Jr., J. David Hann, H. Robert Horvitz, Walter Isaacson,

Shirley M. Malcom, Stephanie Pace Marshall, Anna C. Roosevelt, Robert W.

Shaw Jr., Frank Wilczek, Jennifer Yruegas

Elizabeth Marincola, *ex officio*

**EXECUTIVE OFFICE** *president* Elizabeth Marincola

*outreach director* Jennifer Carter *executive assistant* Madeline Azoulay

**FINANCE** *chief financial officer* Greg Mitchell

*accounting manager* Lisa M. Proctor *senior accountant* Sivakami Kumaran

**EXTERNAL AFFAIRS** *director* Rick Bates

*membership and communications associate* Nancy Moulding

**EVENTS MANAGEMENT** *director of events* Cait Goldberg

*events associate* Marisa Gaggy

**SCIENCE EDUCATION PROGRAMS** *director* Michele Glidden

*program manager, Intel Science Talent Search* Tzeitel Hirni

*office manager* June Kee *program associates* Diane Rashid, Jinny Kim,

Laurie Demsey, Tsharre Tenton

**INTERNAL OPERATIONS** *director* Harry Rothmann

*facilities manager* Paul Roger *logistics manager* Anthony Payne

*program operations manager* Christopher Brown

*computer programmer-webmaster* Thomas D. Smith

*systems and network administrator* James C. Moore

*information technology specialists* Gregory A. Sprouse, Amy An

*mail room clerks* Ben Bryan, Randy Williams

**Society for Science & the Public** is a 501(c)3 nonprofit corporation founded in 1921.

The vision of Society for Science & the Public is to promote the understanding and

appreciation of science and the vital role it plays in human advancement: to inform, educate,

inspire. Visit Society for Science & the Public at [www.societyforscience.org](http://www.societyforscience.org). Republication

of any portion of *Science News* without written permission of the publisher is prohibited.

For permission to photocopy articles, contact Copyright Clearance Center at 978-750-8400

(phone) or 978-750-4470 (fax). Advertising appearing in this publication does not

constitute endorsement of its content by *Science News* or Society for Science & the Public.

## FROM THE EDITOR

# For both universe and life, only constant is change



Evolution isn't always only about life. It isn't even only about sex — although an engaging account by Susan Milius about sex among beetles and other creatures (Page 16) shows how interesting the evolution of sex can be. But it's another story about evolution in this issue, by Ron

Cowen (Page 26), that makes the greater

point. In this case it's the solar system that evolved from birth to a chaotic epoch and then eventually into the cosmic clockwork mechanism that astronomers study today.

When Darwin was young, most “experts” believed that species had been individually created and remained forever immutable. When Einstein was a boy, astronomers believed the universe itself to be eternal and static. And until about two centuries ago, most geologists believed that the Earth itself changed only via occasional catastrophe. But now scientists know that things constantly change. The universe expands, creates new elements, gives birth to stars and galaxies that start young and grow old, changing in appearance and activity.

Life (and its evolution) depended on the physical evolution of the solar system — its initial condition was hopelessly inhospitable to organic organization. Even once Earth became cool and calm enough to harbor living things, the planet itself continued to change, with continents crawling across its surface and new oceans opening up. So evolution isn't confined to bacteria resisting drugs or bodies battling to survive in the struggle for existence. Evolution is about everything.

Science itself evolves as well, not only in the depth of its grasp on nature but also in its methods of investigation. Both better technologies and better philosophies have aided science's advances. Influential authorities once held that science could not concern itself with anything other than what could be directly observed. Even the reality of atoms was denied, as they were too small to see. But clever analysis of indirect evidence established atoms' existence — and demonstrated that scientists could take a broader view of their purview. Theorists now routinely study objects that exist, so far, only as mathematical symbols. Parallel universes beyond visibility are serious objects of scientific contemplation.

Critics argue that such exercises offer no certainty of their validity. But science is not about establishing certainty. It's about understanding change. Certainty is a vestigial concept from the time when constancy supposedly ruled life and the cosmos. There is no constancy in nature — there is only constant change, and lots of it. Experiment and inference from evidence permits science to explain that change in ways much more successfully than other approaches to reality. That success comes at the cost of giving up certainty. But it's a fair trade. — *Tom Siegfried, Editor in Chief*



# BRING YOUR NEW SOY PRODUCT TO MARKET

The INVEST program – funded by the Indiana Soybean Alliance – offers financial support to individuals and small businesses to help them bring new, viable soy products and technologies to the market.

Visit **[www.soy-invest.com](http://www.soy-invest.com)** to apply online.  
Applications are due on March 31, 2009.

For more information, e-mail Ryan West at  
[rwest@indianasoybean.com](mailto:rwest@indianasoybean.com)

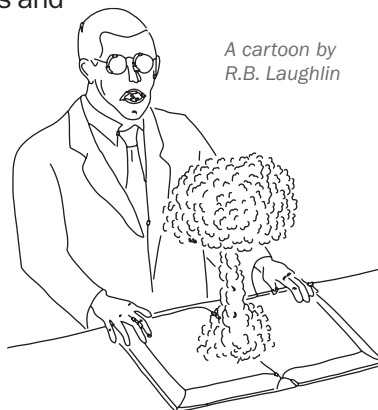


## Scientific Observations

"The growing efforts of governments, corporations, and individuals to prevent competitors from knowing certain things that they themselves know has led to a stunning expansion of intellectual property rights and the strengthening of state classification powers.... Broad areas of two sciences, physics and biology, are now off-limits to public discourse because they are national security risks. Our society is sequestering knowledge more extensively, rapidly, and thoroughly than any before it in history. Indeed, the Information Age should probably be called the Age of Amnesia because it has meant, in practice, a steep decline in public accessibility of important information."

PHYSICS NOBEL LAUREATE

ROBERT B. LAUGHLIN IN *THE CRIME OF REASON* (BASIC BOOKS, 2008)



A cartoon by  
R.B. Laughlin

## SN Online

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

### ENVIRONMENT

PCBs and DDT have sneaked onto the orca menu. A new study shows why southern populations are more contaminated than those in the north. See "Pacific Northwest salmon poisoning killer whales."



## Science Past | FEBRUARY 14, 1959

**POLAR ICE CORES REVEAL TRAPPED "ANCIENT AIR"** — Bubbles of "ancient air" trapped in polar ice may reveal whether the modern industrial world is polluting the atmosphere with carbon dioxide. The air bubbles were found in cores drilled at depths down to 1,345 feet in the Greenland and Antarctic ice caps. The ice originated as snows that fell as long ago as ten centuries. James Bender of the U.S. Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill., said the bubbles are now being analyzed for their carbon dioxide content. If the analysis shows a lower percentage of the gas in the ancient atmosphere and an increase in later years, this will indicate more carbon dioxide enveloping the earth due to industrialization.



## Science Future

### February 23

"When Plasmons Interact, Worlds Collide: The Emerging Field of Nanophotonics" at the National Science Foundation in Arlington, Va. Visit [www.nsf.gov](http://www.nsf.gov)

### March 1

Deadline for submissions to the Chlorofilms plant biology video YouTube competition. Visit [www.chlorofilms.org](http://www.chlorofilms.org)

### March 6

The McAuliffe-Shepard Discovery Center opens in Concord, N.H. Visit [www.starhop.com](http://www.starhop.com)

### BODY & BRAIN

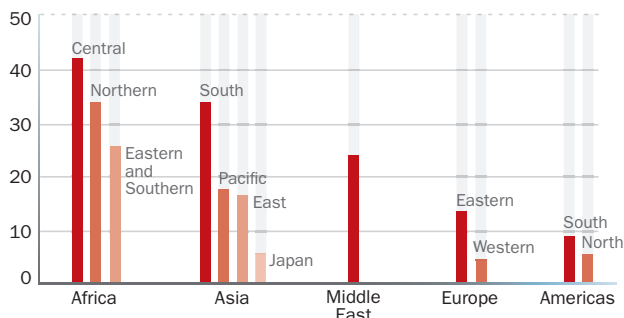
The city that never sleeps should turn off at least some of its lights, suggest studies linking low melatonin production with some cancers. See "Darkness, melatonin may stall breast and prostate cancers."

### ATOM & COSMOS

A tiny crystal in a rock brought back on Apollo 17 dates from the moon's earliest days. See "Oldest zircon fine-tunes history of moon's formation."

## Science Stats | STILLBIRTHS AROUND THE WORLD

Number of stillbirths by region per 1,000 births in 2000  
Total: 3.3 million stillbirths



SOURCE: *THE ATLAS OF THE REAL WORLD*, THAMES & HUDSON, 2008

## How Bizarre

Highly reflective crop varieties can help curb global warming. But first they have to be bioengineered and planted by farmers. A research team from the University of Bristol reports in the Jan. 27 *Current Biology* that increasing canopy reflectivity by 20 percent in all arable land could lead to a 1 degree Celsius reduction in summertime surface air temperatures through much of central North America and midlatitude Eurasia.



CLOCKWISE FROM TOP LEFT: COURTESY OF R.B. LAUGHLIN; BRIAN GIBBORNE/DFO CANADA; TROUT55/ISTOCKPHOTO

“A common belief held by many gamers and many in the video game industry—that violence is what makes a game fun—is strongly contradicted by these studies.” — CRAIG ANDERSON, PAGE 14

**Environment** Warming West, dying trees  
**Earth** Pollution kept Europe mild  
**Atom & Cosmos** Methane hints at E.T. life  
**Science & Society** STS finalists announced  
**Life** To crack a nut, monkeys pick right stone  
**Body & Brain** Borderline brains  
**Humans** Gamers don't need blood and gore

# In the News

STORY ONE

## Epigenetics: From islands to the shores

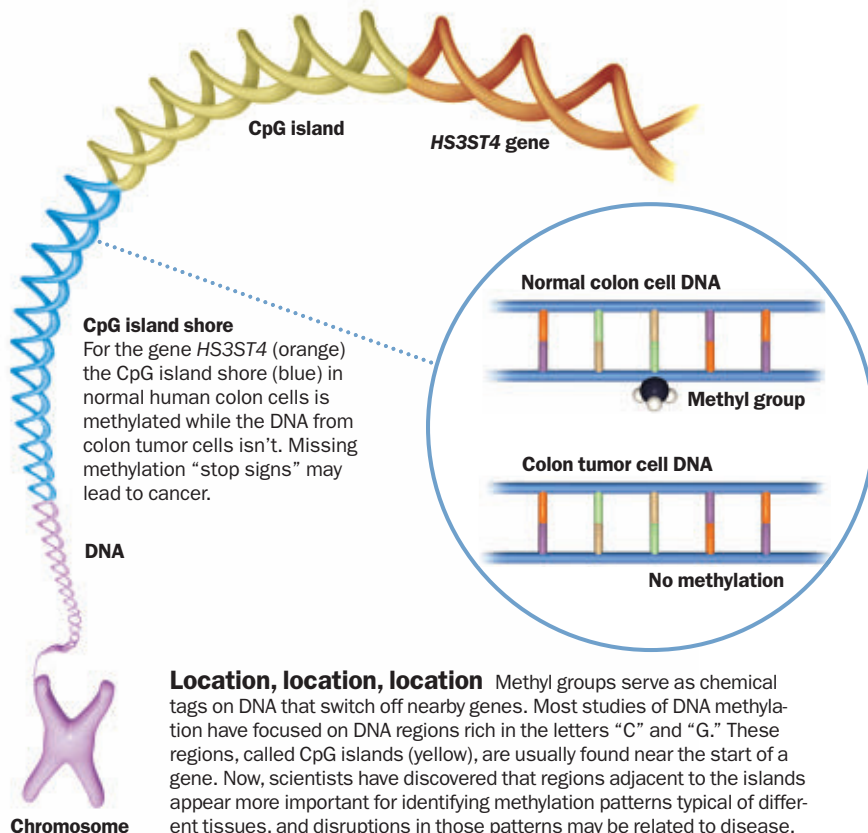
Tissue-specific DNA tagging  
found in unexpected regions

By Tina Hesman Saey

**T**attoos on the skin can say a lot about a person. On a deeper level, chemical tattoos on a person's DNA are just as distinctive and individual—and say far more about a person's life history.

A pair of reports published online January 18 in *Nature Genetics* show just how important one type of DNA tattoo, called methylation, can be. Researchers at Johns Hopkins University report the unexpected finding that DNA methylation—a chemical alteration that turns off genes—occurs most often near, but not within, the DNA regions scientists have typically studied. The other report, from researchers at the University of Toronto and collaborators, suggests that identical twins owe their similarities not only to having the same genetic makeup, but also to certain methylation patterns established in the fertilized egg.

Methylation is one of many epigenetic signals—chemical changes to DNA and its associated proteins—that modify gene activity without altering the genetic information itself. Methylation and other epigenetic signals help guide stem cells as they develop into other types of cells. Mistakes in methylation near certain critical genes can lead to cancer.



**Location, location, location** Methyl groups serve as chemical tags on DNA that switch off nearby genes. Most studies of DNA methylation have focused on DNA regions rich in the letters "C" and "G." These regions, called CpG islands (yellow), are usually found near the start of a gene. Now, scientists have discovered that regions adjacent to the islands appear more important for identifying methylation patterns typical of different tissues, and disruptions in those patterns may be related to disease.

The Johns Hopkins group has now shown that DNA methylation is more common at what they call "CpG island shores" instead of at the CpG islands that most researchers have focused on. CpG islands are short stretches of DNA rich in the paired bases cytosine and guanine, letters "C" and "G" in the genetic alphabet. Methyl groups attach to cytosine bases in DNA.

CpG islands are located near the start sites of genes and help control a gene's activity. It's been thought that planting a methyl group on an island declares the nearby gene off-limits, blocking activity.

Researchers have thought of methylation as a type of long-term memory, pre-

serving environmental effects on genes long after those cues have disappeared, says Rolf Ohlsson, a geneticist at the Karolinska Institute in Stockholm.

Scientists have long suspected that differences in epigenetic marks shaped by environmental cues could account for why identical twins don't look, behave or get sick exactly alike despite having identical genetic makeups. But no one had mapped out all the places, if any, where epigenetic marks differ between twins.

Now a team led by Arturas Petronis of the University of Toronto has explored all of the CpG islands dotting the genome to see which sport methylation flags. The team compared the methylation patterns





For today's top stories, visit  
SN Today at [www.sciencenews.org](http://www.sciencenews.org)

of twins from monozygotic pairs — twins created when a single embryo splits. Although the twins had identical DNA, their methylation of CpG islands varied. But the methylation patterns in monozygotic twins were more similar than those in fraternal twins, who develop from separate eggs. And the group found that the amount of variation between monozygotic twins correlates with the time the embryo split: Counterintuitively, twins from an early-splitting embryo have more similar methylation patterns than twins from a later split.

Epigenetic patterns established in the early embryo are carried throughout life, with some differences introduced by the environment and others by random chance and error in replicating the patterns as a person develops. DNA is reproduced with high fidelity — mistakes happen in about one in a million bases — but the process of reproducing epigenetic patterns in dividing cells is more error-prone, with one in a thousand epigenetic marks going awry.

Petronis thinks the similarity between monozygotic twins results not from shared DNA sequences but from having come from the same embryo. “We don’t see any reason to think that the DNA sequence makes up the epigenetic profile,” Petronis says.

But swimming away from CpG islands

may offer a different perspective. Andrew Feinberg, director of the Epigenetics Center at Johns Hopkins University in Baltimore, and colleagues embarked on a genome-wide tour to chart DNA methylation in different human tissues. The researchers had expected that each tissue would have a characteristic methylation pattern, indicating which genes are turned off and which are turned on to build a liver, spleen, brain or other tissue. Often researchers examine methylation only at CpG islands, but Feinberg says that most islands are surprisingly free of methylation in most tissues.

“We were always a bit skeptical of this island thing,” he says. So the team used a method that could reveal every place in the genome where a methylation flag was staked.

The team did find characteristic patterns in each tissue type, but not in CpG islands, where researchers expected. Methylation flagged DNA in liver, spleen and brain at thousands of places along the CpG island shores. The shores contained about 76 percent of the methylation flags shown to be characteristic of specific tissue types.

“This is a discovery that is totally unexpected,” says Ohlsson. Feinberg’s team has found “a signature of the genome that we weren’t aware of before.”

DNA in mouse tissues also has “shore”

methylation patterns similar to those in corresponding human tissues. About 51 percent of the shores methylated in mouse tissues were also methylated in human tissues, indicating that DNA methylation of CpG island shores is an ancient, and important, method of controlling genes, Feinberg says.

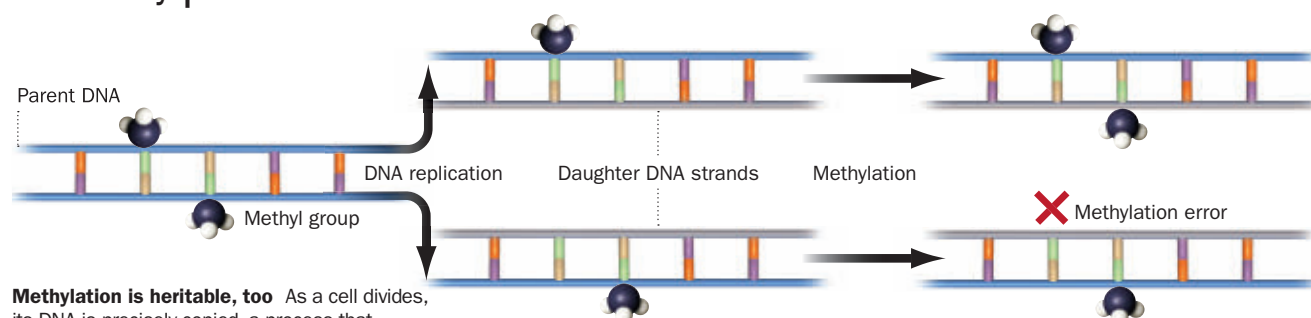
When looking at colon tumors, the team found that methylation patterns in the shores of the cancer cells were more eroded than those in healthy colon cells. Feinberg says a breakdown in the patterns may cause colon stem cells to develop inappropriately, leading to cancer.

Unpublished research by Dag Undlien of the University of Oslo, done on sabbatical in Feinberg’s lab, indicates that monozygotic twins share more shore methylation patterns than fraternal twins do, and are even more similar than Petronis’ research suggests, Feinberg says.

Feinberg thinks evidence from his lab, though preliminary, indicates that DNA sequence does help determine epigenetic patterns. He calls Petronis’ report, “a terribly interesting paper,” but adds, “I think there may be a stronger genetic contribution than is suggested by his data.”

Regardless of who is correct, Ohlsson says that Feinberg’s discovery of CpG island shores will force scientists “to refocus our efforts to figure out what DNA methylation is doing.” ■

## Back Story | METHYL GROUPS MOVE TO THE NEXT GENERATION



**Methylation is heritable, too** As a cell divides, its DNA is precisely copied, a process that underlies inheritance. Other systems then kick in to ensure that epigenetic tags such as methyl groups are replicated faithfully. DNA replication results in two parental DNA strands (blue), with methyl groups intact, and two new daughter strands (gray), which are not yet methylated.

A class of enzymes recognizes unmethylated DNA — specifically the DNA letter C — across from methylated sites on the parent strands. The mismatch prompts the enzyme to add methyl groups to the daughter strands, reproducing the original parental pattern (right top).

Errors in methylation can occur (above bottom) and lead to cancer-promoting changes. Environmental factors, even in the womb, also can change DNA methylation, which may lead to some differences, such as incidences of diseases and obesity, between identical twins.

CHARLES FLOYD, J. KORENELAT; SOURCE: B. ALBERTS, A. JOHNSON, J. LEWIS, M. RAFF, K. ROBERTS, P. WALTER/MOLECULAR BIOLOGY OF THE GENE 2002



**Extremely  
Limited Availability**

1 carat marquise-cut  
DiamondAura® bail

3/8 ctw round  
DiamondAura® accents

5 carat pear-cut  
DiamondAura® center

Set in .925 sterling silver

***Special Offer\****

**Receive \$200 in Stauer  
Gift Certificates with the  
purchase of this necklace.  
Yes, you read that right.**

## Better Than FREE?

**Stauer gives back! Get our 6-carat French Pear Pendant for \$195 and get **\$200** in gift certificates!**

**B**etter than free? Believe it. Stauer is returning some of its success to our many clients with the lavish, limited edition 6-carat *French Pear Drop Pendant* along with a special gift.

Despite tough economic times, Stauer has had a very good year. Now it's time to give back. That's why when you purchase the DiamondAura® *French Pear Drop Pendant* Necklace for \$195, you'll receive two \$100 Stauer gift certificates. That's **\$200** you can use on any of our hundreds of pieces of fine jewelry, vintage watches and luxury goods. Basically, we're paying you to shop Stauer.

**Breaking the big-carat barrier.** DiamondAura® has proven to be a magnificent lab creation since we first released it five years ago but, up until now we couldn't make a DiamondAura® pendant larger than 2 3/4 carats. Today we release the ultra-luxury, majestic lab-created DiamondAura pendant with stunning clarity, cut and color rarely seen. Our Pendant features a 5 carat, pear-cut DiamondAura that dangles from an 18" chain of the finest .925 sterling silver. The pear is topped with an impressive 1 carat marquise-cut DiamondAura bail.

**The Four Cs.** Our exclusive DiamondAura jewelry has splendid specifications: color, clarity, cut, and carat weight. We won't

COMPARE FOR YOURSELF AT 6 CARATS		
	Mined Flawless Diamond	DiamondAura Compares to:
Hardness	Cuts Glass	Cuts Glass
Color	"D" Colorless	"D" Colorless
Clarity	"IF"	Clear
Dispersion/Fire	0.044	0.066
6 ctw necklace	\$200,000+	<b>\$195</b>

bore you with the details, but we've invested close to \$6 million in developing DiamondAura. The complex laboratory process involves rare minerals heated to an incredibly high temperature of nearly 5,000° F inside some very modern and expensive equipment. Using chemistry, we found a better way to match the fire and brilliance of a "D" flawless diamond at a much more reasonable cost.

**Here's the plain truth:** Times are tough, people are strapped and the bottom has dropped out of our economy. It doesn't matter if you're from Wall Street, Main Street or Rodeo Drive, everything has changed. If you have a house, a 401K or a bank account... you've taken a financial hit. But you still need to surprise her with something that will truly take her breath away.

**Sound to good to be true?** Let me explain: at Stauer we don't make money selling one piece of jewelry to you, we stay

in business by serving long term clients. Our data tells us that when you become a Stauer client, you'll be back.

**Even a Recession has a silver lining.** If you are not thrilled with the DiamondAura *French Pear Drop Pendant*, return it within 30 days for a refund of your purchase price. Our DiamondAura will last forever, but our **limited edition** will not. Call today to take advantage of this offer.

**JEWELRY SPECS:**

- 5 carat pear-cut center DiamondAura®
- 1 carat marquise-cut DiamondAura® bail
- Set in precious .925 sterling silver
- 18" princess-length chain of .925 tarnish-free sterling silver

**French Pear Drop Pendant Necklace  
(6 ctw) only \$195**

***Special Offer\**—Receive \$200 in Stauer  
Gift Certificates with the purchase of  
the French Pear Drop Pendant**

**\*\*\*Due to expected demand, this is a  
very limited time offer. Call today!\*\*\***

*Call now to take advantage of this limited offer.*

**1-800-721-0386**

**Promotional Code PDN127-02**  
Please mention this code when you call.

**Stauer** 14101 Southcross Drive W.,  
Dept. PDN127-02  
Burnsville, Minnesota 55337  
**www.stauer.com**

*Smart Luxuries—Surprising Prices*

# Environment



For longer versions of these and other Environment stories, visit [www.sciencenews.org](http://www.sciencenews.org)

## Trees fall faster as air heats up

Routine deaths in the West doubled over 50-year span

By Susan Milius

Those trees falling in the forest with no one listening—in the changing climate of the West, they're falling about twice as fast as 50 years ago, says a new study.

These “noncatastrophic” mortalities aren't the result of wildfires or huge outbreaks of pine beetles. The recent increase in temperature is probably to blame, reports a team of researchers from eight institutions in the Jan. 23 *Science*.

Records from 76 plots of apparently healthy, old-growth temperate forest in the western United States and Canada show that the small number of routine tree deaths in a year has doubled since 1955. Rates of routine tree deaths in these locations, now 1 or 2 percent annually, are exceeding the tree birth rate, the team reports.

The numbers may sound tiny, but they compound over time, says coauthor Mark E. Harmon of Oregon State University in



**Monitoring in the West, such as that done over the Gifford Pinchot National Forest in Washington state, shows that the rate of routine tree death is increasing.**

Corvallis. “A lot of little numbers can add up to a big number.”

Forests could dwindle to sparser spreads of younger, skinnier trees if the trend continues, said Phillip J. van Mantgem of the U.S. Geological Survey's field station in Arcata, Calif., during a January 21 teleconference. Purer forests might store less carbon. Biologists count on these forests as absorbers of carbon dioxide, but van Mantgem cautions that the finding “raises the possibility that western forests could become sources of carbon dioxide to the atmosphere, further speeding up the pace of global warming.”

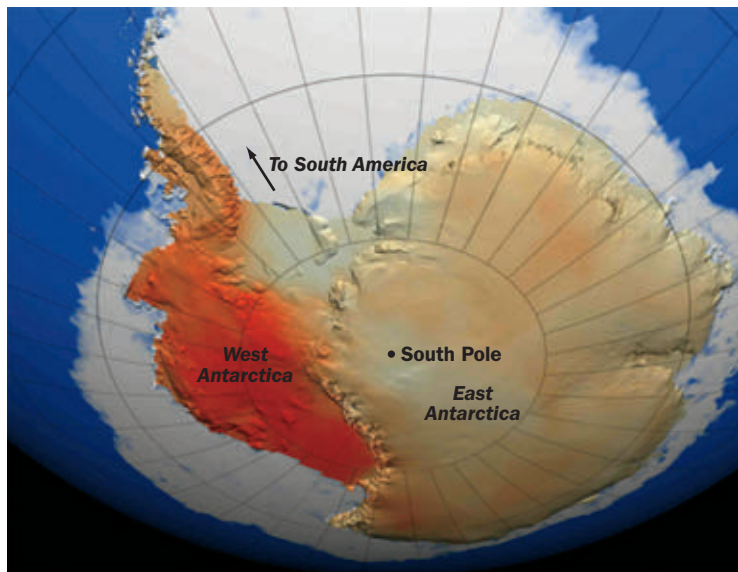
Oliver Phillips of the University of

Leeds in England welcomes the study as “the first report that I know of at this scale in the temperate zone.” Work he and others have done in the tropics shows that the growth of new trees there is keeping pace with the death of old ones.

Tree data for the study came from mortality surveys conducted between 1955 and 2007. At least one study has suggested that from the 1970s to 2006, the mean annual temperature of the western United States increased at a rate of about 0.3 to 0.4 degrees Celsius per decade.

Because mortality has edged upward in a wide range of trees, the team looked to some widespread environmental effect. Recent warming has altered water dynamics in the West and longer summer dry spells might stress trees. Also, warmer temperatures could be boosting populations of diseases and pathogens.

The researchers make a good case for climate change as the driver of such effects, Andrew Sugden, an editor at *Science* who has studied tropical rain forest ecology, said at the teleconference. 🌳



## Antarctic warming

Contrary to previous studies, much of Antarctica has warmed in recent decades, researchers report in the Jan. 22 *Nature*. To assess long-term climate trends for the entire icy continent, Eric Steig of the University of Washington in Seattle and his colleagues blended meteorological data collected at 42 weather stations since 1957 with satellite data gathered since 1982. Though a small region of East Antarctica cooled slightly between 1957 and 2006, East Antarctica as a whole warmed about 0.1 degrees Celsius during the same interval. The largest rate of warming showed up in West Antarctica, where the average temperature increased about 0.17 degrees C per decade during the period. For comparison, global average temperature has increased about 0.12 degrees C per decade since 1957. —Sid Perkins 🌐

FROM TOP: UNIV. OF WASHINGTON; NASA, E.J. STEIG





# Cleaner air means warmer Europe

Decline in fog, haze may fuel 10 to 20 percent of warming

By Sid Perkins

A substantial part of the long-term warming seen in Europe during recent decades is the result of reduced pollution and fog, a new study suggests.

Aerosols — tiny particles or droplets suspended in the atmosphere, such as fog, smoke and various pollutants — scatter light and cut down on visibility. But aerosols also scatter the sun's incoming radiation back into space, thereby cooling the atmosphere just above ground level, says Pascal Yiou, an atmospheric scientist at the Laboratory of Climate Sciences and the Environment in Gif-sur-Yvette, France. Yiou and colleagues recently studied the link between aerosols and cooling by analyzing temperature and daytime visibility data gathered at 342 weather stations throughout Europe from the late 1970s through 2006.

During those three decades, visibility has improved substantially, the researchers report online January 18 in *Nature Geoscience*. In part, the air is clear because of pollution-control measures.

Europe now experiences, on average, about nine fewer days with visibility of two kilometers or less during fall and winter than it did three decades ago. In spring and summer, the continent's weather stations see, on average, three fewer days with visibility two kilometers or less. Each decline is about 50 percent over the three-decade period.

Similarly large declines have been measured in the number of days with visibility of five kilometers or less and days with eight kilometers or less.

Comparing data taken at weather stations located within 100 kilometers of each other, the researchers found that the

temperature at a locale where the visibility was less than two kilometers was also typically about 2 degrees Celsius lower than the temperature where visibility extended more than 15 kilometers.

This long-term decline in aerosol concentration over Europe has therefore led to increased warming on the continent, the researchers say. All together, data suggest that average temperatures have warmed about 0.08 degrees Celsius per decade since the 1970s — between 10 and 20 percent of the total warming in

**In eastern Europe, a decrease in aerosols accounts for about 50 percent of warming over the past three decades.**

Europe during that period, Yiou and colleagues report. The rest of the warming stemmed from factors such as changes in weather patterns and increased levels of greenhouse gases such as carbon dioxide.

In eastern Europe, where air pollution was particularly bad before the fall of the Soviet Union in 1991 devastated economies there, the long-term decrease in aerosols accounts for about 50 percent of the warming seen in the past three decades, the researchers estimate.

The new findings on aerosol cooling “could improve climate models, which now typically don’t include such effects,” says Yiou.

“This is an interesting paper, and the results are reasonable,” says Jeffrey Gaffney, an atmospheric scientist at the University of Arkansas at Little Rock. “But, is this [study] the complete answer?” Probably not, he notes, because the analyses didn’t distinguish between the light-colored sulfate aerosols commonly associated with emissions from coal-fired power plants, which have an overall cooling effect, and the darker, smoky aerosols generated by burning wood and other biomass, which can have a warming effect. ■

## MEETING NOTES

American Meteorological Society  
January 11–15, Phoenix, Ariz.

### World's windiest ocean region

A buoy anchored southeast of Greenland gathered data in one of the world's most hostile environments for more than five months, until the really rough weather of winter arrived. Then the buoy snapped free—but not before it confirmed satellite data suggesting the region is the world's windiest for oceans. Ian Renfrew of the University of East Anglia in Norwich, England, and colleagues tethered a weather buoy to the 3-kilometer-deep seafloor off Greenland's southern tip in the summer of 2004. At least 10 times that summer and fall, instruments measured winds exceeding 20 meters per second (about 45 miles per hour), the researchers report.

—Sid Perkins

### Rain machines

Tropical cyclones, including hurricanes and their weaker cousins, typically last only a short time and cover a relatively small area. But at some latitudes these storms provide a substantial part of a region's rainfall, a new study suggests. Using satellite data, Christopher L. Williams, a recent graduate of Georgia Tech in Atlanta, and Frank Marks Jr. of NOAA's Hurricane Research Division in Miami estimated rain amounts dumped by the cyclones and total worldwide rainfall for 1998–2007. Overall, tropical cyclones drop about 2 to 3 percent of the world's rainfall. But at latitudes between 15° and 30°, rain is less abundant, and tropical cyclones account for as much as 17 percent of annual rainfall. —Sid Perkins





# Plumes of Martian methane hint at possible underground microbial life

But emissions could just be signs of geochemical processes

By Ron Cowen

No one is suggesting that Mars has flatulent cows, but a new study shows that the Red Planet, like Earth, spews methane. Researchers say it's possible that the gas could be generated by bacteria living beneath the Martian surface.

The methane emissions, observed over three Mars years (seven Earth years), come from three locations and vary with the seasons — strongest in Martian summer and weakest in winter, Mike Mumma of NASA's Goddard Space Flight Center in Greenbelt, Md., and his colleagues report online January 15 in *Science*.

Methane is a fragile compound, and the variations in its concentration indicate that methane in the Martian atmosphere lasts for less than one Earth year and is constantly being replenished, Mumma says. That suggests that even if the planet isn't biologically active, some unknown geological process is very much alive, continually releasing methane into the air.

To detect the methane, Mumma and colleagues monitored Mars from Earth, using three ground-based spectrometers to spread infrared light into its component wavelengths. Using a new algorithm that removed extraneous signals from Earth's atmosphere, the team detected three absorption features that conclusively prove the presence of methane plumes on Mars.

"Mumma and his team have been painstakingly careful," comments astrobiologist Christopher Chyba of Princeton University. "The reward is that we have observations of methane that show variations over season and by location."



**Scientists have discovered that Mars spews plumes of methane into its atmosphere.**

The European Space Agency's orbiting Mars Express had previously found hints of methane, but the craft's spectrometer isn't sensitive enough to make a definitive measurement, says Jack Mustard of Brown University in Providence, R.I.

In 2003, when the observations began, one of the plumes released about 19,000 metric tons of methane. The plumes were detected over locales that show either evidence of ancient ground ice or the flow of liquid water, including the Nili Fossae region, an area east of Arabia Terra and the southeast quadrant of an ancient volcano called Syrtis Major.

Another team recently reported that Nili Fossae contains carbonates, which form only when liquid water is present.

Mumma and colleagues say that their measurements can't discriminate between biological and nonbiological sources of methane. But the team cites two possibilities for how the methane might be delivered into the atmosphere.

In one scenario, the warmer temper-

atures of Martian spring and summer vaporize ice that in colder months blocks cracks and fissures in rock, allowing methane that had accumulated underground to seep into the Martian atmosphere. During winter, the ice redeposits, once again plugging up the cracks.

Another possibility is that reserves of methane, rather than being sealed inside ice-covered rocks, are trapped inside molecular cages called clathrates. During Martian summer, the increased sunlight striking the icy clathrates directly liberates the trapped methane.

In either case, the methane might have been produced as a by-product of a purely geochemical process in which iron oxide is converted into another group of minerals called serpentines. That process occurs on Earth and might also happen on Mars.

"It's entirely possible that the signature is due to methanogenic microorganisms, but nonbiological mechanisms have also been proposed and a biological explanation can't be embraced unless we have stronger evidence," says Chyba. "Nor should it be dismissed."

Livestock and decomposing plants account for more than 90 percent of the methane in Earth's atmosphere, but terrestrial methane-producing bacteria are also known. If some kind of microscopic life is producing the Martian methane, it could reside underground, where temperatures may be warm enough for water to be liquid, says Mumma.

The team says it can't determine whether the methane now being released into the atmosphere was produced recently or billions of years ago. But an old reservoir of methane is problematic, Mumma says, because it would be hard to explain how it could be steadily released over billions of years. That would suggest that if bacteria are indeed the source of the methane, the organisms are active now.

# Science & Society



Winners of the 2009 Intel Science Talent Search will be named March 10. For updates, visit [www.sciencenews.org](http://www.sciencenews.org)

## Youth scientists to show stuff

Forty students rose to the top from a pool of 1,608 entrants in the 2009 Intel Science Talent Search, America's oldest high school science competition. The finalists will travel to Washington, D.C., in March to compete for \$530,000 in scholarships.

"It will fall to this generation of young scientists to address the world's greatest scientific, technological, environmental and health challenges," says Elizabeth Marincola, publisher of *Science News* and president of Society for Science & the Public, which runs the program. "Society for Science & the Public is proud to join with Intel to encourage their continued dedication to scientific inquiry."

The finalists, announced Jan. 28, are:

### Arizona

**Smitha Ramakrishna**,  
Corona del Sol H.S., Tempe  
**California**

**Aniruddha Sandeep Deshmukh**, Bellarmine  
College Preparatory  
School, San Jose

**Nitish Lakhnapal**,  
University H.S., Irvine;

**Marianna Yuling Mao**,  
Mission San Jose H.S.,  
Fremont; **Julia Dory**

**Ransohoff**, Menlo-Atherton  
H.S., Atherton; **Nilesh**

**Tripuraneni**, Clovis West  
H.S., Fresno

### Connecticut

**Aditya Rajagopalan**,  
Choate Rosemary Hall,  
Wallingford

### Florida

**Maxim Rabinovich**,  
Shorecrest Preparatory  
School, St. Petersburg

### Illinois

**Elizabeth Jie Rao**, Lincoln

Park H.S., Chicago;

**Eric Shyu**, Illinois  
Mathematics and Science  
Academy, Aurora

### Massachusetts

**Noah Maxwell Arbesfeld**,  
Lexington H.S., Lexington

### Minnesota

**Michael Sheng**

**Cherkassky**, Edina H.S.,  
Edina; **Stephen Walter**

**Trusheim**, Breck School,  
Minneapolis

### Missouri

**William Jayang Sun**,  
Parkway Central H.S.,

Chesterfield

### New Jersey

**Doris Chen**, Tenafly H.S.,  
Tenafly; **Radomir**

**Kratchmarov**, Livingston  
H.S., Livingston; **Hayden**

**Craig Metsky**, Millburn  
H.S., Millburn

### New York

**Patrick Jeffrey Abejar**,  
Smithtown H.S. West,

Smithtown; **Jocelyn**

**Chuang, Joseph Li**,  
The Bronx H.S. of

Science, Bronx; **Abigail**

**Sara Greene**, John Jay

H.S., Cross River; **Chelsea**

**Lynn Jurman**, Roslyn H.S.,

Roslyn Heights; **Anissa**

**Yuenming Mak**, Adam

**Benjamin Sealfon**,  
Stuyvesant H.S., New York;

**Preya Shah**, **Christine Lee**

**Shrock**, Ward Melville H.S.,  
East Setauket

### Ohio

**Elizabeth Charlotte**

**Coquillette**, Caitlin

**Maureen Mann**, Hathaway

Brown School, Shaker

Heights; **Tong Zhan**,  
William Mason H.S., Mason

### Oklahoma

**Melissa Nicole Carvell**,  
Bartlesville H.S., Bartlesville

### Oregon

**Eric Kemer Larson**,  
South Eugene H.S., Eugene;

**Michael Loy**, Oregon

Episcopal School,

Portland

### Pennsylvania

**Janet Song**, Methacton

H.S., Norristown

### Texas

**Wen Chyan**, Texas

Academy of Mathematics

and Science, Denton;

**Michael Tyler Wham**,  
Sterling Ridge home

school, The Woodlands

### Virginia

**Alexander Mee-Woong Kim**,  
Narendra Pundarik

**Tallapragada**, Thomas

Jefferson H.S. for Science

and Technology, Alexandria

### Wisconsin

**Gabriela Aylin Faran**,  
West H.S., Madison;

**Suvai Gunasekaran**,  
James Madison Memorial

H.S., Madison; **Philip Vidal**

**Streich**, home school,

Platteville

## ALL THE PARTS YOUR CAR WILL EVER NEED

"RockAuto is the best car parts supplier. I shopped around and couldn't beat their prices. Order was placed on a late Thursday night, part was shipped Friday. The website is easy to navigate. I have told and will continue to tell people, if it's parts you need for your car, RockAuto.com is the way to go."

Customer testimonial from an independent, third-party survey.

### Price Comparison 2006 Dodge Charger R/T Axle Bearing & Hub Assembly

Parts Store	Part Brand	Price
RockAuto	National	\$99.79
NAPA	NAPA	\$139.00
Autozone	Timken	\$139.99
Advance	National	\$183.99
Checker, Schucks, Kragen, Murrays, & O'Reilly	National	\$183.99

(as of 1/12/2009) RockAuto price is regular price, NOT a special sale price created for this comparison.

✓ Huge Selection  
✓ Everyday Low Prices



✓ Fast Shipping  
✓ Easy to use Website

GO TO [WWW.ROCKAUTO.COM](http://WWW.ROCKAUTO.COM) 1-866-ROCKAUTO (762-5288) ROCKAUTO, LLC - MADISON, WI USA



For longer versions of these and other  
Life stories, visit [www.sciencenews.org](http://www.sciencenews.org)

## Monkeys pick the right rock

Wild capuchins may plan to use most effective tool

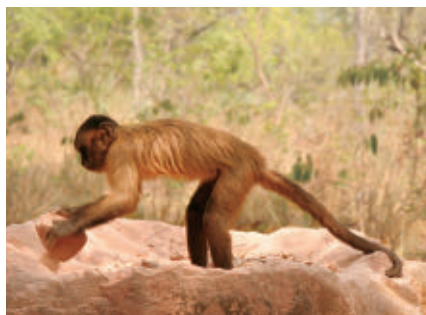
By Bruce Bower

Wild capuchin monkeys don't thoughtlessly grab any handy piece of stone to crack open hard-shelled nuts at snack time. These agile primates select the best tool for the job, a new study finds.

Capuchins make mental plans for fracturing a particular nut before selecting an appropriate stone for the task, say primatologist Elisabetta Visalberghi of the Institute of Cognitive Sciences and Technologies in Rome and her colleagues. These monkeys draw on knowledge about a variety of stones and nuts to select suitable nut-cracking implements, the scientists report in a study published online January 15 in *Current Biology*.




In a clear example of tool use, a wild capuchin smashes a nut with a stone.



"The present findings make capuchins a compelling model to track the evolutionary roots of stone-tool use," Visalberghi says. Because capuchins last shared a common ancestor with humans about 35 million years ago, the scientists write, the capacity for stone-tool use evolved earlier than thought.

In Visalberghi's study, wild monkeys in Brazil individually approached two or three stones that differed in hardness, size or weight. One stone was best for cracking nearby palm nuts. In nearly every

case, animals chose the superior stone.

Primatologist Frans de Waal of Emory University in Atlanta interprets the findings differently. The work underscores wild capuchins' proficiency at trial-and-error learning, and planning need not have contributed to the animals' tool preferences, he says. Having spent their lives learning to associate certain types of stones with nut-cracking success and others with failure, monkeys in the new study might have automatically applied that knowledge, he suggests. 

## 8 million 'lost' bats maybe weren't

Imaging and algorithms challenge famous Carlsbad estimate

By Susan Milius

Eight million is a lot of bats to lose, and now a new unpublished study may explain what happened to the possibly lost bats of Carlsbad Cavern. Short answer: The famous 8 million bats never existed in the first place, a Boston University team says.

From spring to fall, the cavern in New Mexico still hosts as many as hundreds of thousands of migratory Brazilian free-tailed bats that thrill visitors by boiling out of the cave at dusk for a night's foraging. All the roosting bats emerge in a dense plume that streams on and on, sometimes for an hour or three.

As with many wildlife spectacles, always present is the disturbing possibility that today's show is a mere wisp com-



A view of Carlsbad Cavern's mouth shows bats swarming out to forage.


pared with the great Carlsbad bat clouds of yore. In 1937 V.C. Allison estimated the bat numbers by timing an emergence (14 minutes at great density; four minutes at half that) and eyeballing the stream's speed and size. About 8.7 million bats roosted in the cavern, he reported.

Since then, estimates have varied but

haven't topped a million. Consequently, some conservationists have raised alarms about Carlsbad's bats.

To count bats, Thomas Kunz of Boston University and colleagues set up thermal imaging cameras at the cavern in 2005. Margrit Betke, also of B.U., developed algorithms for analyzing the recordings.

In a series of counts in 2005, numbers varied from a low of not quite 70,000 to a peak about 10 times higher weeks later. Even at the peak, counts came up some 8 million bats short of the old estimate. The Boston team's modeling found that at most 50,000 bats could exit a choke point in the cavern per minute, limiting the number of bats in 1937 to 1 million. Carlsbad Caverns National Park has discounted Allison's numbers as excessive, says park biologist Renée West.

"That doesn't mean these bats aren't declining," says researcher Nickolay Hristov, now at Brown University. "The declines just haven't been as bad." 

FROM TOP: E. VISALBERGHI; NICKOLAY HRISTOV, LOUISE ALLEN





## Neural circuits foster oversensitivity

Borderline personality patients activate brain in specific ways

By Bruce Bower

People diagnosed with the mental ailment known as borderline personality disorder hemorrhage emotion. Real or perceived rejections, losses or even minor slights trigger depression and other volatile reactions that can lead to suicide.

New brain-imaging research suggests that in such people specific neural circuits foster extreme emotional oversensitivity and an inability to see other people as having both positive and negative qualities.

Psychiatrist Harold Koenigsberg of Mount Sinai School of Medicine in New York City described his team's results January 17 in New York City at a meeting of the American Psychoanalytic Association.

"I suspect that in social situations, people with this disorder activate the brain in unique ways," Koenigsberg says.

The findings unveil brain networks that may underlie the "faulty brakes" that borderline personality patients attempt to apply to their emotional reactions, remarks psychiatrist John Oldham of Baylor College of Medicine in Houston.

Borderline personality disorder affects one in five psychiatric patients, says Koenigsberg. It most often affects women, especially those who are depressed, and men who display violent and criminal tendencies classed as antisocial personality disorder. About one in 10 people with borderline disorder commits suicide.


Koenigsberg's group first tested 19 adults with borderline personality disorder and 17 others with no serious psychiatric con-

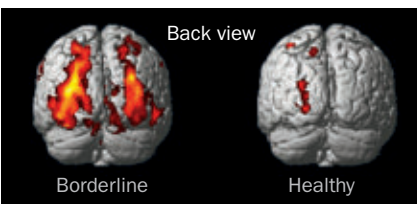
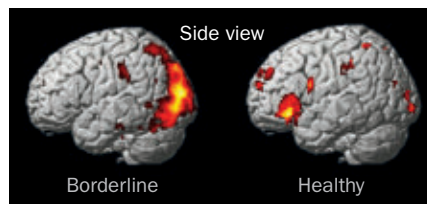
ditions. While in an fMRI scanner, participants viewed five pleasant images — such as a laughing man playing with two children — and five disturbing images, including a man assaulting a young woman.

Whether the images were pleasant or disturbing, borderline personality disorder patients displayed heightened blood flow — a marker of neural activity — in the brain's chief visual area and in the amygdala, a key structure in emotion regulation. This finding fits with earlier evidence that borderline personality disorder patients detect brief facial emotional expressions that emotionally healthy people typically do not notice.

In a second experiment, 18 borderline personality disorder patients and 16 healthy volunteers viewed a series of neutral images and disturbing images. In some trials, participants simply looked at the images; in others, participants tried to assume the role of a detached observer.

As detached observers of disturbing scenes, emotionally healthy participants displayed pronounced activity in brain areas implicated in regulating attention and resolving conflicts. Borderline personality disorder patients showed almost no activity in those brain regions when trying to take a detached perspective.

Most people have the ability to perceive both favorable and negative aspects of a person, helpful in resolving conflict. Lacking this skill, borderline patients end up veering back and forth between regarding those they know as either wonderful or awful, Koenigsberg suggests. 




**While viewing disturbing images, patients with borderline personality disorder show greater activity in the brain's visual system than emotionally healthy volunteers.**

### NEWS BRIEFS


#### Scalpel, check, sponges, check ...

Reading a list of procedures aloud and checking them off before and after surgery can reduce complications by more than one-third, a new study finds. In 2008 the World Health Organization released a checklist designed to limit surgical complications. In the new study, reported online January 14 in the *New England Journal of Medicine*, researchers analyzed complication rates at hospitals in four low-income countries and four higher-income countries before and after checklist use began. Complications occurred in 11 percent of patients operated on by teams not using a list, compared with 7 percent of cases in which a list was used. Checklist use halved death rates in the low-income countries. Death rates changed only negligibly in higher-income countries.

—Nathan Seppa 

#### Daily stress and dementia risk

People who typically don't get distressed by routine events that unnerve others seem to have a lower likelihood of dementia in old age, concludes a study in the Jan. 20 *Neurology*. Laura Fratiglioni of the Karolinska Institute in Stockholm and colleagues assessed personality and lifestyle traits for 506 elderly Swedes. The data suggest that people with low distress levels and high extrovert scores were least likely to develop dementia. The findings also suggest that a socially active lifestyle may provide a buffer against the risk of being easily distressed. But in people leading isolated lives, low distress scores still seemed to offer some protection against dementia.

—Nathan Seppa 

# Humans



For longer versions of these and other Humans stories, visit [www.sciencenews.org](http://www.sciencenews.org)

## Gamers crave sense of control

Feeling competent matters more than violence, blood

By Laura Sanders

Blood, guts and gore aren't what thrill avid gamers when they slaughter zombies in *The House of the Dead III*, a new study suggests. Instead, video game players crave feelings of control and competence. The new research, led by psychologist Richard Ryan at the University of Rochester in New York, appears in the February *Personality and Social Psychology Bulletin*.

"A common belief held by many gamers and many in the video game industry — that violence is what makes a game fun — is strongly contradicted by these studies," comments psychologist Craig Anderson, who directs the Center for the Study of Violence at Iowa State University in Ames.

Many studies aim to determine how video game violence impacts players. Recently, lawmakers in the U.S. House of Representatives introduced a bill requiring violent video games to carry the following label: "WARNING: Excessive exposure to violent video games and other violent media has been linked to aggressive behavior."

Some psychologists and lawmakers think the link between exposure to violence and committing violent acts is well substantiated, but others, including Ryan, think the topic is "unfinished business."

To figure out how enticing violence is for gamers, Ryan and his colleagues conducted a series of survey-based studies to identify the reasons players enjoy a certain game. Two surveys, based on responses from more than 2,500 people who participate in an Internet chat group on video games, found that violent content did nothing to enhance players' enjoyment. What did matter

was a feeling of control and a feeling of competence. "Games give autonomy, the freedom to take lots of different directions and approaches," Ryan says.

In a smaller experiment, the researchers modified a popular first-person shooter video game called *Half-Life 2* to have less gore. Half the people in a group of 36 male and 65 female college students dispatched adversaries as the original game intended, "in a thoroughly bloody manner," says Ryan. The other half tagged enemies with a marker. "Instead of exploding in blood and dismemberment, they floated gently into the air and went back to base," Ryan describes.

A survey of the two groups showed that excluding violence didn't diminish players' enjoyment of the game.


In a different trial, 39 male gamers — who were, on average, 19.5 years old

and played video games for 7.5 hours a week — played *The House of the Dead III* with a low-violence or high-violence setting. In the low-violence version, the

wounded were covered in neon green goo instead of realistic blood. As before, violence did not affect players' enjoyment of the games.

Feelings of competence and autonomy are factors important to many different aspects of happiness, according to Ryan's previously proposed self-determination

theory. Bruce Bartholow, a psychologist at the University of Missouri in Columbia, is not surprised that the same is true for video game enjoyment. "It's a decent thing to know, but it's not something to shout from the rooftops," he says.

Bartholow also cautions that the new study did not take subjects' past exposure to violence into account. 

**"Games give autonomy, the freedom to take lots of different directions and approaches."**

RICHARD RYAN

## Newborns don't miss the beat

Days-old babies show neural signs of detecting rhythms

By Bruce Bower

Sonny and Cher once crooned that the beat goes on, but little did they know that the beat starts up within days of birth. A new study suggests that the brains of 2- to 3-day-old babies recognize when a rhythmic sequence lacks its initial beat, or downbeat. The downbeat corresponds to the downstroke of a conductor's baton at the beginning of a musical measure.


Newborns automatically perceive the downbeat of a sequence of sounds, thankfully without having to snap their fingers or tap their toes, says psychologist and study director István Winkler of the Hungarian Academy of Sciences in Budapest, who reports the work with colleagues online January 26 in *Proceedings of the National Academy of Sciences*.

It's unclear to what extent this ability

depends on innate biology versus hearing rhythmic sounds, such as a mother's heartbeat, in the womb, Winkler notes.

Questions remain about whether newborns can detect musical beats, comments psychologist Glenn Schellenberg of the University of Toronto at Mississauga.

In the new study, the downbeat consisted of a simultaneous bass drum and cymbal sound. The babies, who wore scalp electrodes, heard either this sound or a pause. Only the cymbal sounds were omitted at other times.

The newborns showed a larger brain response to omissions of a pair of sounds than to omissions of single sounds, says Schellenberg. "These results do not tell us that babies were detecting the beat, but simply that a larger change in the sound pattern elicited a greater neurological response." 

Summon Emergency Help Immediately

# “This pendant saved my life.”

Exclusive **Designed For Seniors™** MedicalAlarm is a life-changing, lifesaving solution. Help when you need it *most*:  
*Medical Emergency – Accident – Fire – Burglary*



## Simple

- No contract
- Large buttons
- Easy 5 minute setup

## Reliable

- 48 hour battery backup
- 24/7 monitoring
- Lifetime warranty
- Waterproof pendants

## Affordable

- Free equipment
- Free activation
- Lowest monthly rate
- Second user – FREE

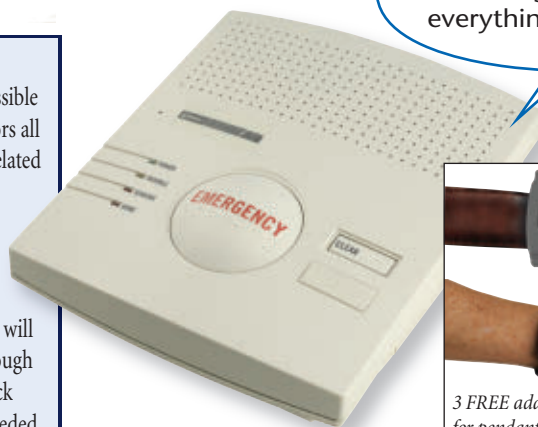
Dear Friends,

At Designed For Seniors™ MedicalAlarm, we have the simple notion that it's possible to provide great care, great service, and peace-of-mind --- affordably --- for Seniors all across America. Unlike other companies we've eliminated all the up front costs related to our service... no equipment to buy/rent, no activation fee, and no contract.

Our monthly fee is the lowest available – plus a second user in the same household is always *free*.

**How it Works.** In an emergency, push your button, which sends a wireless signal to your medical unit allowing it to contact us toll free. Within seconds you will hear the reassuring voice of a member of our highly trained monitoring staff through the “whole house” two-way intercom unit attached to your home phone. We check on your status and dispatch your local Emergency Medical Services and/or the needed assistance of a nearby friend, neighbor, or family member. And, because no one likes to be alone in an emergency, we maintain voice contact with you until someone arrives!

**“Peace-of-mind” that is always on!** We believe our policies and concerns for our clients set us apart from other companies. We provide you with the highest rated equipment on the market today, combined with the reliability and precision of our state-of-the-art monitoring center. You will even have a personal Life Safety Representative that you can call with any questions or concerns. We provide a service that is unparalleled and we NEVER compromise when it comes to your safety! Our entire staff from the sales team to technical assistance will treat YOU as if you were their own loved one... and that's a promise!



**Call now for more information on how the  
Designed For Seniors™ MedicalAlarm  
can keep you safe, and save you money!**

**1-888-830-7953**

*Please mention promotional code 37730  
for FREE Shipping.*

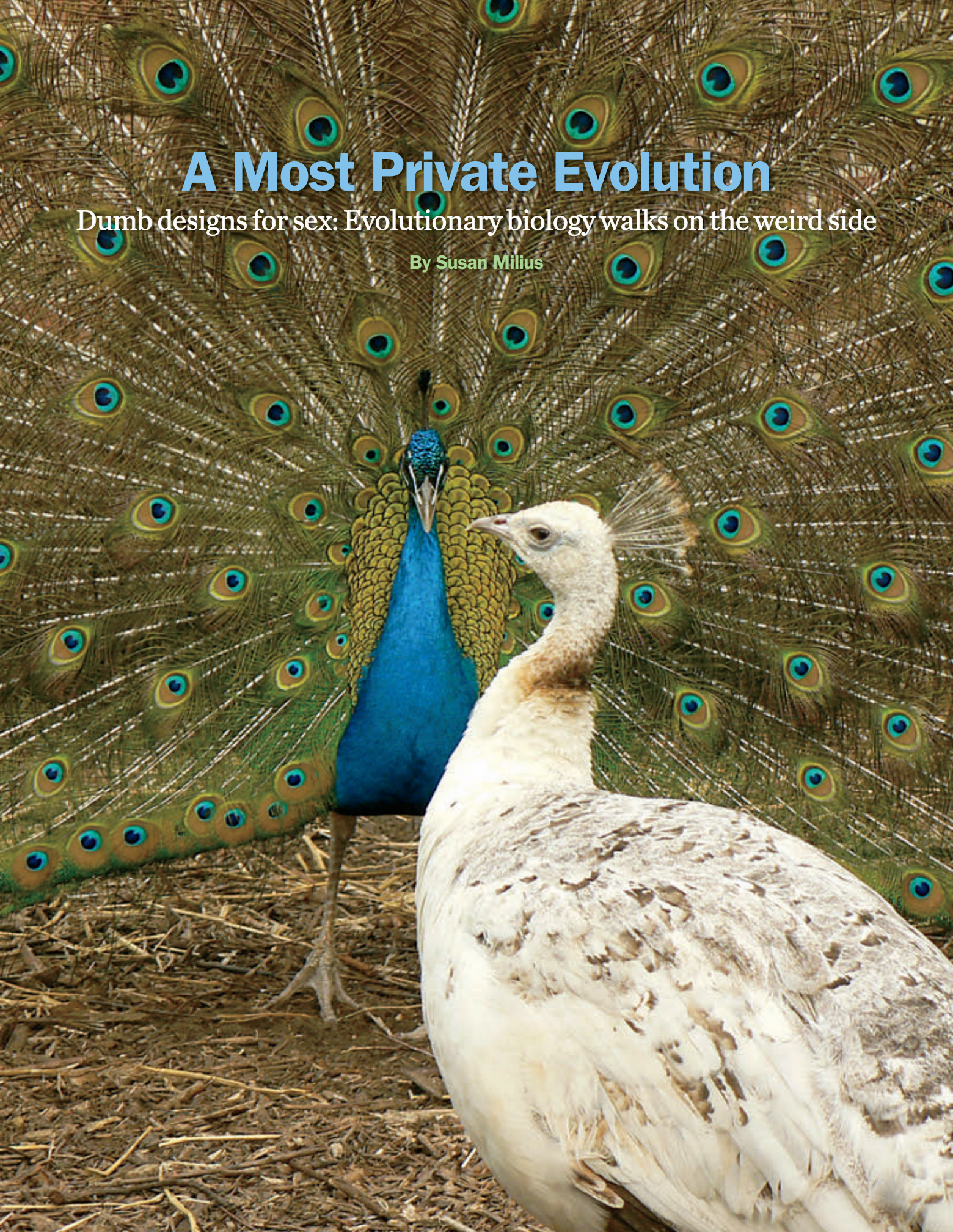
**[www.DesignedForSeniors.com](http://www.DesignedForSeniors.com)**



# A Most Private Evolution

Dumb designs for sex: Evolutionary biology walks on the weird side

By Susan Milius





**M**aybe female seed beetles have their own what-the-bleep exclamation. Even for insects, it's difficult to imagine any other reaction to a male *Callosobruchus maculatus* beetle's sex organ, which has spikes.

"It jumps to mind as something quite dumb," says Göran Arnqvist, an evolutionary biologist at Uppsala University in Sweden, who for much of the past eight years has studied seed beetle sex.

Male beetles of several *Callosobruchus* species have sharp edges on their sperm-delivery organs. The females' ducts grow a bit of extra toughening but not enough to make sex safe from the risk of injury. After many tests, Arnqvist has concluded that the genital excesses aren't good for the species as a whole. These seed beetles would have less-damaging sex—and would produce more babies—if males lost their edges.

Discussions of evolution often glorify the beautifully apt forms: orchids with nectar recesses just the right length for the tonguelike structure of a certain moth, or harmless butterflies with the same wing colors as a poisonous neighbor. Yet the most dramatic examples of the power of evolutionary theory may come from the strange and ugly stuff—biology that seems too dumb to have been designed.

Trying to understand counterintuitive sexual parts and habits follows in the best of scientific traditions. As Charles Darwin worked on evolution, he pondered male phenomena that looked useless, or even harmful, for surviving. Outsized horns on male beetles puzzled him, as did male birds with gorgeous plumage.

Out of this consternation came his insight into a process he called sexual selection, which he distinguished from natural selection. There may be survival of the fittest, but there's also survival of the sexiest.

Today the sex-related selection pro-

cess doesn't get much attention outside scientific circles, but it's a powerful tool for making sense of downright peculiar stuff. Arnqvist and other biologists are expanding Darwin's framework, exploring the counterintuitive aspects of sex from flirtation to family life. And theorists are discussing female behavior that Darwin never recognized, or perhaps just didn't care to discuss in print.

### Not-so-natural selection

When Darwin first put his full idea of natural selection into print, he knew it wasn't enough. In 1859, he argued in *On the Origin of Species* that organisms best adapted to their environment survive in greater numbers and leave more offspring than do their less fit neighbors. Thus more suitable traits gradually replace clunkier versions.

Yet antlers on stags and tails on peacocks could hardly be adaptations to the environment. Both antlers and tails may be so familiar that it takes a minute to summon a sense of their absurdity. They're huge. They must drain energy to produce. There's no way they improve agility in locomotion or foraging.

"The sight of a feather in a peacock's tail, whenever I gaze at it, makes me sick!" Darwin wrote in a letter to the botanist Asa Gray, albeit in a whimsical paragraph. Nauseated or not, Darwin was willing to step beyond survival of the fittest.

He devoted a few pages in the *Origin* to introduce sexual selection as a sort of wild-oats younger brother of natural selection. Sexual selection, as Darwin formulated it in the sixth edition of *Origin*, depends "not on the struggle for existence in relation to other organic beings or to external conditions, but on a struggle between the individuals of one sex, generally the males, for possession of the other."

Antlers evolved as stag-on-stag weaponry for fights over a female, he argued. Males also compete in contests "of a more peaceful character," he wrote. Extravagant plumage, singing and what he called "strange antics," such as bird acrobatic displays, bedazzle a female into choosing one male over his rivals.

What's good for bedazzling can be bad for survival, of course. Darwin made a glancing allusion to the conflict in his 1871 work, *The Descent of Man, and Selection in Relation to Sex*. There he admits that sexy traits could be slightly harmful to the male.

### Today's tales

Harm may be part of the charm, although debate continues on how supersized, shimmery tails evolved. The year 2008 proved a lively one for peacock studies, as a long-term line of research met a challenge from a new one.

Three independent studies in the past 20 years have found that tails matter. For example, Marion Petrie of Newcastle University in England and a colleague turned the same birds from hotties to notties and back again by clipping some of the eyespots out of the males' tails and then reattaching the finery. The females probably weren't counting male spots, but were choosing males that displayed a greater density of spots, according to similar tests by Adeline Loyau, now at France's CNRS Moulis station.

Peahens' interest in eyespots could have arisen for no particularly practical reason, Petrie and Loyau speculate. Their idea draws on the concepts of sensory bias and sensory exploitation, which deal with an apparently arbitrary silliness at the heart of sexy traits. Sure, a blue spot now burns hot with allure. But biologists puzzle over why a purple stripe didn't evolve instead.

In this scenario, basic arbitrary-looking evolutionary directions (blue not purple; long tail, not wide eyes) actually were arbitrary as far as mate choice goes. For some reason that had nothing to do with reproduction, females might have tended to notice a particular color or shape or motion.

Let's imagine it was a blue spot. Males exploit that predisposition, as guys with even a modest dot attract extra female attention. If the female bias gets inherited along with male coloring, then off go the males in an evolutionary race for bigger, better, bluer blues.

That kind of scenario might have

**The finery of a male peacock's tail feathers attracts a more drably garbed peahen. Among evolutionary biologists, debates still boil on tail origins and use.**

begun the peacock's tale. At some point, the story goes, tails grew so fancy they posed a handicap for males. Growing the best tail or keeping it flossy or managing a little sprint despite its weight demanded energy or vitamin-rich food or something otherwise limited. And in animal communication, that's when fashion starts to mean something.

What's called the handicap principle comes from the Israeli biologist Amotz Zahavi, now retired from Tel Aviv University, who thought about how creatures judge each other's quality.

Suppose the peacock's tail signals, "Hey, honey, I'm the best bird, and you need me right now." Such a tail stays reliable as a badge of quality across generations only if good tails present a handicap that not all individuals can overcome, Zahavi suggested. A robust bird can pay the cost and still look good. A puny bird can't compensate for the loss, and looks like a second-rater. The tail signal honestly indicates quality.

A signal with no cost, Zahavi argued, means anybody could waggle a full rainbow rear. Everybody could signal "best bird." The signal would lose its utility and fade away over generations, or never evolve to begin with.

Petrie and others have been taking this signaling idea further, testing to see whether the tail might signal good genes or some true benefit for a female who mates with a showy male. It sure isn't help with the chores and the chicks. Peacocks do only the most basic task of fatherhood.

In a jolt after years of research linking female preferences to tail feathers, readers of the journal *Animal Behaviour* were

startled to learn last April that a seven-year study of feral peacocks in a park near Shizuoka, Japan, found no sign that females were choosing males based on their tails. Neither eyespot number, tail symmetry nor tail length correlated with a male's success or his health, reported Mariko Takahashi of the University of Tokyo and her colleagues.

Loyau, Petrie and two other researchers responded in the November issue with ideas about why the new study doesn't agree with old research.

For one thing, the researchers point out, the new study took place on the opposite side of the world. Other animal studies have recently detected what's called adaptive plasticity in mate choice, or differences in how various groups of females of the same species choose mates. What's a useful signal in one environment may not matter much in another.

Also, Loyau says, "If we really want to understand, we need to study peacocks in the wild."

One commentary isn't going to settle a matter that's been under study since it nauseated Darwin, though. The Japanese study's challenge to years of experiment, theory and assumption is "sure to prove controversial," predicts Louise Barrett, one of the journal's editors.

**Male and female seed beetles engage in evolutionary arms races that appear to harm the species as a whole. Species with spinier, more dangerous male genitals (most extreme of three species at left) also have tougher walls in the female reproductive tracts (inset, cross section for each species).**

## For kicks

Plausible explanations for a dazzling but impractical tail don't make sense for injurious genital spikes. Beetle genitalia look more like instruments of war. The latest research suggests warfare may be the point.

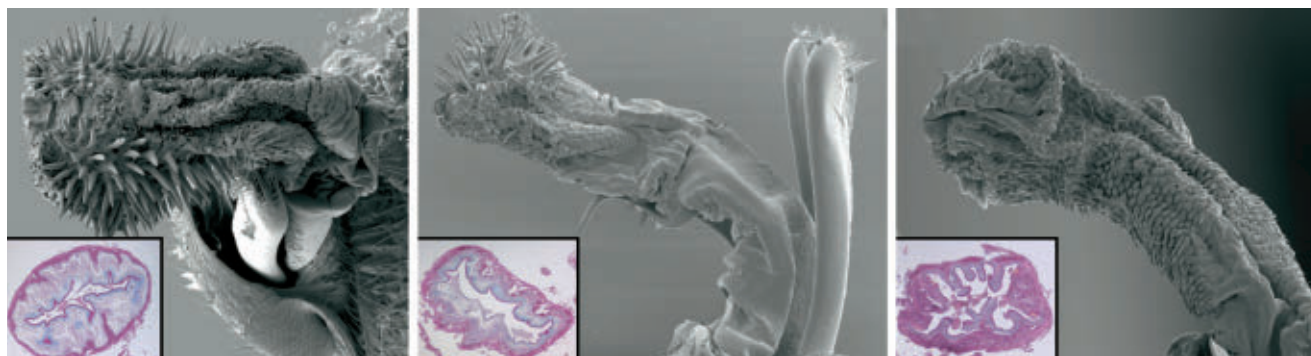
In Darwin's writings, males fought males. Now researchers recognize that males and females clash too.

As Arnqvist puts it, "Unless you have perfect monogamy, there are conflicts of interest." When a male and a female can take different strategies in mating, their best interests often differ. What's good for the goose in terms of how often to mate, with whom and for how long probably won't be best for the gander.

Thus human scientists confront the question of how to spot battles of the sexes in other species. In a 2000 paper in *Nature* titled "Genital damage, kicking and early death," two researchers reported evidence that seed beetle mating might have more conflict than concord. Helen Crudgington and Mike Siva-Jothy of the University of Sheffield in England timed beetle mating that takes place on black-eyed peas. After about three minutes, females start slamming their hind legs against the male. A typical mating encounter lasts about four minutes.

When the researchers removed females' legs so they couldn't kick, males persisted around six minutes. The sexes appear to disagree about how much is enough.

Female beetles' kickoffs probably are not a way of reducing contact with wimpy males that can't stand a drubbing, Siva-Jothy says. Female seed beetles look as if they have genuine cause to minimize mating. The longer an encounter lasted,





the more rips and tears Siva-Jothy and Crudgington found in the female reproductive tract. And as additional evidence of harm, females that mated only once during the experiment lived longer than females that mated twice.

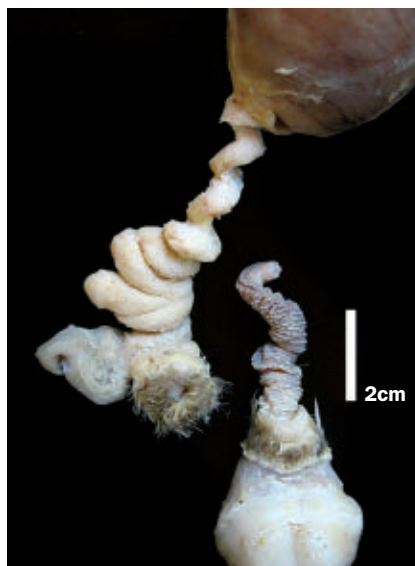
Those harmful male sex organs in the beetles “look like medieval torture instruments,” Arnqvist says. Yet such a device may not have evolved through any direct benefit of its power to injure. Instead, injuries are probably side effects, Arnqvist contends.

He and his colleagues have tested for potential direct benefits for the male, including what’s called the “terminal investment.” In a terminal investment, a mauled creature facing an uncertain or shortened life span throws all resources and effort into the current batch of young. A dad with no guarantee he’ll sire one of mom’s future clutches will certainly benefit if he can get her to make an all-out investment in his offspring right then.

Exactly mimicking the damage of mating isn’t possible, so Arnqvist and his colleagues inflicted other injuries, including body punctures or cuts on wings, after a group of females had mated. The injured females actually laid fewer eggs than intact moms did, so Arnqvist dismissed the idea of a terminal investment bonus for the males. Also, the damaged females tended to mate again sooner than usual, so the damage doesn’t appear to be a roundabout way of foiling rivals.

To explain how the sharp edges of a seed beetle arose without direct benefits, Arnqvist proposes that some quirk of male physiology, such as an irregular surface to improve anchoring, injured females incidentally. The risk of such injuries favored females with tougher plumbing, which in turn favored spikier males. So seed beetle anatomy, he argues, could derive from an ongoing arms race between the sexes, even if the conflict harms the species.

Similar harm, and possibly arms races, could be smoldering far beyond seed beetles. “Being an entomologist, I know of hundreds of insect groups with male genitalia that have this appearance,” Arnqvist says.



**Mallard duck anatomy shows signs of an escalating battle of the sexes. The male has a long phallus (bottom), but the female genitals (top) corkscrew in the opposite direction.**

Some male insects deploy bundles of spines, knives and even full-fledged swords. Male bedbug organs look like a stiletto, and “they literally use it as a stiletto,” Arnqvist says. Females’ reproductive tracts do have external openings, but male bedbugs usually just stab through some spot in the body wall and let the sperm swim from there.

### Duck difficulties

Birds have evolutionary arms races too, says Patricia Brennan of Yale University. Most birds don’t have insertable parts, achieving fertilization by the so-called cloacal kiss. It’s just his-to-hers contact of cloacae, the all-purpose openings of reproductive and excretory systems. Male ducks, however, belong among the 3 percent of male bird species with a phallus; some duck organs extend 40 centimeters.

In the mallard and long-tailed duck, males deploy at unusual length “what looks like a weird tentacle with bumps and ridges,” Brennan says.

Female duck anatomy hadn’t received as detailed a look until Brennan spent some time in Tim Birkhead’s lab at the University of Sheffield. Female mallards and long-tailed ducks have a correspond-

ingly intricate reproductive tract “like a maze,” Brennan says.

In studying 16 species, she found that if the male had a long and elaborate phallus, the female had intricate genitals too. The sexes’ intricacies seemed at odds with each other, however. Males spiraled counterclockwise (from the base) but female reproductive tracts antagonistically curved clockwise (from the outer opening). Blind pouches along the female tracts looked like traps for sperm.

A classic arms race is what Brennan and Birkhead proposed in *PLoS ONE* in May 2007 to explain the mismatched genitalia. Males of the extra-long species are more likely to try forcing themselves on females than are less elaborated males. Thus females might have benefited from countermeasures against unsuitable matings. A maze that proves navigable only when a female cooperates and relaxes could have provided some control, but it would also favor the evolution of even more extreme males.

“These kinds of evolutionary races are costly,” Brennan says. “You would have been better off without this conflict in the first place, but you can’t stop investing because you’re already in the war.”

There’s chemical warfare too, says William Rice of the University of California, Santa Barbara. Male fruit flies dope their seminal fluids with a cocktail of additives that revs up the female so she devotes extra resources to the eggs. Never mind that it shortens her life and therefore shrinks the total number of offspring she can produce.

Possible high-quality offspring won’t make up for loss in quantity, Rice and his colleagues report in the November *Journal of Evolutionary Biology*. They tested the idea that mating with a male carrying superb genes might, over the course of generations, give a female enough extra grandkids and great-grandkids to compensate for her initially small brood.

Yet breeding experiments showed that good genes don’t help enough, the researchers conclude. At most, females mating with a superior male might get a modest increase in the number of their offspring’s descendants. The uptick isn’t

big enough to compensate for the downside of drugged sperm. This evidence and earlier work show fruit flies paying a toll for their battle of the sexes. “It’s clearly bad for the species,” Rice says.

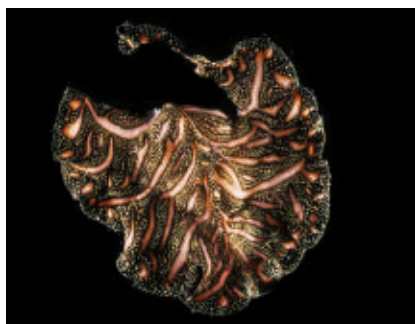
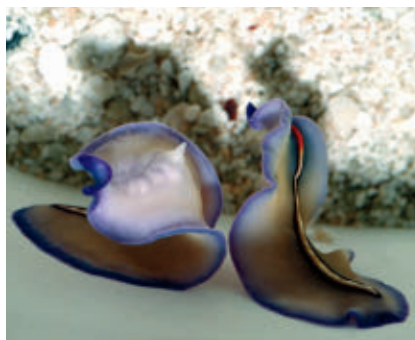
Even hermaphrodites can have battles of the sexes. Conflicts arise when everybody tries to play the guy instead of the girl, according to ongoing work by Nico Michiels and Nils Anthes of the University of Tübingen in Germany.

Just why it would be better to be “male” has inspired much theorizing about sperm being energetically cheaper than eggs to produce. Anthes, though, does the accounting in different terms. He sees conflicts looming if one sex, usually the male, benefits from virtually unlimited matings while the other sex rapidly reaches some limit. Females, for example, might be able to produce only so many eggs in a lifetime, so attempts to fertilize even more eggs wouldn’t be useful.

Whatever drives the conflicts, researchers see what looks like a lot of antagonism out there. In the small marine flatworm *Pseudoceros bifurcus*, two flatworms stand up on the hind parts of their bodies, stick out both their penises (each worm has two) and jab them at each other. Worms bend and dodge as any duelists would, trying for a hypodermic strike that injects sperm anywhere on the opponent’s body. Bouts sometimes last 20 minutes.

In the flatworm *Pseudobiceros bedfordi*, ejaculate dissolves its way through skin and can leave scars. A full splash can dissolve the recipient into two pieces, although the flatworms do regenerate lost body parts.

The latest battle that Michiels and Anthes have documented “turned out to be quite spectacular,” Anthes says. Hermaphroditic *Siphopteron quadrispinosum* sea slugs stab at each other with a sharp spike on the side of the penis. When one slug gets spiked in the head region, it slows down and stops dueling. The target looks “pretty sleepy,” Anthes says. The spiker is apparently injecting some kind of sedative that allows unilateral insemination, Anthes and Michiels reported in 2007 in *Biology Letters*.



**Combining both sexes in one body doesn’t eliminate conflict. Two hermaphroditic marine flatworms (*Pseudoceros bifurcus*) struggle for the male role in a duel (top) to be the first to inject sperm into the opponent’s body (middle). Sperm from *Pseudobiceros bedfordi* can dissolve through skin, but too big a splash corrodes the recipient into fragments (bottom).**

Counterintuitive reproductive strategies continue even into parenthood. Consider the penduline tits (*Remiz pendulinus*). In any given nest, the mother and/or the father often desert and start a second family, says Tamás Székely of the University of Bath in England. A single parent can still raise chicks to adulthood, given the right location, but sometimes both parents desert. In these cases, the chicks starve. In populations across Europe, about a third of

egg clutches die from abandonment, Székely and his colleagues have found.

To make sense of this, Székely describes a competitive desertion arms race between male and female tits. Each sex can increase its number of offspring by starting another nest with a new partner, as long as the old partner stays around to care for the previous clutch.

As the optimal time for desertion nears, when all eggs have been laid, female tits behave as if they’re trying to keep their current mate from seeing the true number of eggs. Females confront a male at the nest opening and fuss at him furiously.

Whether this loss of a third of clutches ends up as a bad thing for the species overall will take more research, says István Szentirmai at Órség National Park in Hungary. But he speculates that the strategy limits the species to insect-rich places like wetlands, where a single parent can catch all the necessary baby food.

Mothers certainly didn’t run off with other males in *On the Origin of Species*. Darwin acknowledged that males of various species take more than one mate but said hardly anything about such shocking behavior (to mores of the era) in females. So one of the biggest developments in the theory of sexual selection has been the recognition that females in many species aren’t monogamous, says Jeanne Zeh of the University of Nevada, Reno.

“It’s molecular genetics,” says David Zeh, also at Reno. Once DNA analysis could identify the true fathers of offspring, biologists could see widespread challenges to old ideas of females as the choosy, monogamous sex. That idea opens the way for much entertaining science.

Reproduction in the modern view isn’t particularly pretty. With medieval torture instruments, mazes and corkscrews, drugged sperm and arms races everywhere, reproduction looks more like war than love. All in all, it’s easy to wonder if sex itself was such a great idea.

But that’s another story. ■

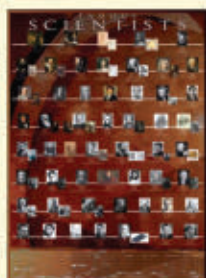
### Explore more

■ G. Arnqvist and L. Rowe. *Sexual Conflict*. Princeton Univ. Press, 2005.

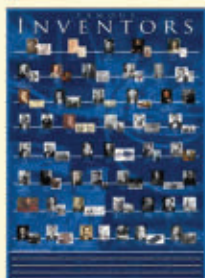




**Rocks, Minerals and Gemstones of the U.S.**, 100 piece set, size: 20" L X 12" W X 1" D, Oak casing. Great for classrooms, collectors or young scientist. Suitable for wall hanging. For safety, no glass cover. Comes with free meteorite and information sheet. **Order #JPT-1888, Cost: \$85.00**, plus shipping; also available: **WORLD Minerals, Rocks and Gems Collection #JPT-78131 price: \$265**. This beautiful walnut display case contains 102 samples. Comes with information and is ready for wall hanging, and perfect for anyone fascinated by the earth sciences. Size: 24" L X 18" W X 2" D



**Famous Scientists Poster** - 54 of some of the world's premier scientists are shown in photographs on this 24" W X 36" L laminated poster. The poster lists their name under each picture as well as their nationality, life span and field of study. A time line at the bottom of the poster shows the seven sciences with their major branches. **Order #JPT-2000, Cost: \$15.95**, 2 for \$30, **order #JPT-2017-2**



**Famous Inventors Poster** - 50 of some of the world's well known inventors are shown in photographs on this 24" W X 36" L laminated poster. Names are under each picture as well as their nationality, life span and invention. A time line at the bottom of the poster shows many of the major inventions, corresponding to the inventors listed. **Order #JPT-87033, Cost: \$15.95**, 2 for \$30, **order #JPT-87033-2**



This is the NEW, colorful **Visual Electromagnetic Spectrum** chart, copyright 2009. An ocean of seen and unseen waves surround us. This chart has been updated with latest bandwidth information but contains all the traditional information (wavelength and frequency scale) and more! Interesting photos with corresponding subject matter enhance it for easier learning. Information sheet included! Comes laminated. Size: 26" L X 38" W **Order #4100, Cost: \$24.95**; Two for \$45, **Order #4103**

**Order by phone Toll Free: 1-800-720-5451, 24 hour service line, free gifts**



**Stunning Wreath Pendant**. Sterling Silver and rhodium-plated with multi-cubic zirconia. Size: approximately 21x30mm. Comes with 20" Sterling Silver Chain in an attractive black velvet jewelry box. **Order #JPT1272, Cost: \$55**



**Through the Sound Barrier** Poster - One of the extraordinary sights associated with breaking the sound barrier is the production of a sudden visible vapor cloud around the aircraft. This picture is a famous classic! Poster size: 16" X 20", Laminated **Order #JPT-121, Cost: \$24.95**. Also available in black or walnut frame: **Order #JPT-1277, Cost: \$85**



**Sterling Silver Butterfly Wing Pendant** - Real, Beautiful shimmering, iridescent green; Size: 1 3/8" L X 7/8" W, Comes with a 20" sterling silver chain in a beautiful crystal jewelry box with authenticity. **Order JPT-81447B, Cost: \$39.99**



**Visible Color Spectrum Rectangular Rainbow Pendant** - crafted in Sterling Silver and Dichroic Glass. This pendant is securely framed in sterling silver. Comes in a black velvet gift box with 20" sterling silver chain with information. **Order #JPT-9128, Cost: \$55**



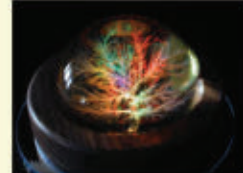
**Mammoth Ivory Rose Pendant** - The ivory rose was made from ancient fossil Mammoth Ivory that lay buried in the snows of Alaska for over 50,000 years. The yearly melting of the snow and minerals in the earth have given the mammoth ivory it's unique color. The ivory was unearthed by Eskimos and carved by a master carver. Wire-wrapped in 14K gold. Comes with matching chain. A perfect gift for anniversary, birthday, Christmas or "just because." Actual pendant size: 1 1/2" L X 1" W. Ivory rose dimensions: 3/2" L X 5/8" W **Order #JPT-rose16, Cost: \$185**. Larger pendants with earrings are available at: [www.sciencemail-usa.com](http://www.sciencemail-usa.com)



**Libyan Desert Glass** - Authentic Pendant - Famous glass from an impact site in the Libyan Desert. Prices vary on the website. 14K Gold and Sterling Silver pendants are available. Pendant pictured: **Order #JPT-0184, 14K Gold, Cost: \$385**



**Infinity Poster, Classical Version** Colorful, Artistic Poster - Size: 22" X 28.5" Comes Laminated **Order #JPT-1681, Cost: \$16.95**, 2 for \$30; With light blue matching frame; **Order #JPT-1478; Cost: \$110**; Now available as a fine art print, framed - call for details - toll free 1-800-720-5451



**Lichtenberg Figures** Lichtenberg Figures are fractal-like branching patterns that have been permanently captured within crystal clear acrylic plastic. Lichtenberg Figures combine the technologies of particle beam and dielectric physics with the natural beauty of fractals. Comes with information and authenticity. Available with and without lighted stands. **Order #JPT-6851 Cost: \$185**; Other styles are available on the website.



**Sumerian Medical Tablet** Ancient Reproduction - Earliest Known Prescription Written in Cuneiform - This piece is a reproduction of a Sumerian medical tablet. It is the earliest known prescription. It is written in cuneiform. Along with the tablet you will receive a booklet which gives you the translation and history of the tablet. The original was found at Nippur. (c. 2100 B.C.) It comes with a walnut stand and detailed information sheet size: 6" H X 3" W by 1" D **Order #JPT-sumer, Cost: \$69.95** Legal Tablet also available **Order #JPT-legal, Cost: \$65.95** **Ideal gifts for lawyers, doctors, students, teachers, writers**



**"Teardrop" Amber Pendant with Gold Spangles** - Comes with a 20" 14K Gold Chain and Bail in an attractive black velvet jewelry box, with authenticity and information. **Order #JPT-1115, Cost: \$65.00** Other styles are available on the website



**Beautiful Specimens of Fulgurites** "Lightning Sand" are now available on our website with a wide selection of samples, sand pendants, and a wind chime. **Sterling Silver Lightning Sand Pendants: Order #JPT-11444, Cost: \$ 89.95; 14K Gold Lightning Sand Pendants: Order #JPT-16441, Cost: \$199.99** Individual lightning sand samples 1" **Order #JPT-1831, Cost: \$18.95**



**World's End** - Colorful Poster - Mysteriously interesting, imaginative, and a real piece of classic artwork. Size: 24" W X 36" L; Laminated, **Order #JPT-1110, Cost: \$16.95**; 2 for \$30



# The Dating Go Round

Speed dating offers scientists a



## Dating is hell.

It's a tiptoe traipse on a high wire strung across the Grand Canyon. One wrong move and you're in free fall, tumbling crazily toward a final goodnight. It's no accident that single adults laugh and commiserate over dating horror stories. Tales of dating bliss just don't cut it at the watercooler.

Dating can also be a monumental chore. All too often, someone who seems cute and funny chatting in line at the coffee shop turns into a date from — well, you know.

Enter Rabbi Yaacov Deyo. He is generally credited with inventing speed dating in 1998 to help Jewish singles in

Los Angeles meet each other. Deyo gave people literally looking for love a way to cut to the chase and perhaps even avoid catastrophic spills.

In the past decade, speed dating has spread. No major metropolitan area in the United States, the United Kingdom, Australia or Canada lacks speed dating opportunities. Entrepreneurs now run events for speed networking, speed interviewing and speed friending. About a dozen speed dating companies have emerged as major players in the United States. That doesn't include, though, specialty operations geared toward arranging meetings between members of particular groups, such as Christians or gays.

Even psychologists have gotten into the act, for purely scientific reasons. Without intending to, Deyo devised a way to study real-life romantic attraction and relationship formation. That's no small feat — couples who have just met and started dating are usually in no mood to be scrutinized by nosy researchers.

At a typical speed dating event, the romantically inclined pay a fee to go on a series of brief "dates" with potential partners. Men sit across from women, and the pairs of speed daters talk for no more than eight minutes. Each man then moves and sits across from another woman. This process continues until all the men and women have had brief conversations.

## peek at how romance actually blossoms **By Bruce Bower • Photography by Cary Wolinsky**



Afterward, speed daters describe on a questionnaire or a website which people they would or would not want to meet again. If two participants express interest in each other, the host of the event provides them with contact information so that the pair can chat further or arrange a traditional date.

For the past 40 years, attempts to discern how relationships get off the ground have largely relied on questionnaires and laboratory tasks that probe for qualities people value in prospective dates and mates. “There’s a big difference between evaluating people’s dating preferences on paper and evaluating living, breathing potential partners,” says psychologist

Eli Finkel of Northwestern University in Evanston, Ill.

New speed dating research indicates that men and women in fledgling relationships anxiously long for an emotional bond with each other, even if it takes years for such a connection to form. This gut-wrenching reaction may draw couples together with the same pull as mutual sexual desire.

Speed dating investigations also illuminate a considerable gap between what people say they’re looking for in a romantic partner and traits of the people they actually want to go out with. Some evidence raises doubts about whether men value women’s physical attractiveness

and whether women cherish men’s financial prospects to the degree that questionnaire responses would suggest.

Other findings hint that, for good evolutionary reasons, female speed daters become more choosy as they meet larger numbers of potential dates. Evolution may also lie behind women’s tendency to mask their romantic intentions more than men do. Intriguingly, though, during speed dating, women’s dating palates become much less discriminating if they move from one man to the next, rather than waiting for men to approach them.

No other available research method could yield such findings, remarks psychologist Lisa Diamond of the University

of Utah in Salt Lake City. “It cracks me up that speed dating was invented by a rabbi because it seems like it was designed by a psychologist,” Diamond says.

### Worried love

The late psychologist Dorothy Tennov studied love more than 30 years ago, well before the advent of speed dating. After interviewing thousands of people, she concluded that romantic passion feeds off a mix of hope and uncertainty. Love grows out of opposing beliefs that the other person reciprocates one’s feelings but, at the same time, may not really be as interested as he or she seems, Tennov proposed.

A speed dating study conducted by Finkel and Northwestern University psychologist Paul Eastwick supports Tennov’s view. Worries about desired partners’ underlying romantic feelings flare up in many people — and it is this worry that motivates pursuit of the relationship, Eastwick and Finkel say. Anxiety toward a love interest, combined with hope that one’s feelings will be returned, triggers the same attachment system that forges emotional bonds between children and their parents, Eastwick and Finkel conclude in the September *Journal of Personality and Social Psychology*.

“We see an embryonic stage of the attachment process as soon as a person develops a romantic attraction to someone else,” Finkel says. Scientists have usually assumed that mutual sexual desire largely motivates people to pair up in the first place, with attachment bonds forming only after at least two years together.

Eastwick and Finkel conducted seven speed dating events for college students, 81 women and 82 men. After an event, students used a website the researchers set up to both view and communicate with matches. For one month after a speed dating session, students visited the website every three days and completed relationship-related questionnaires.

In particular, the scientists tracked what they call partner-specific attachment anxiety. Volunteers scored high on this measure by affirming statements such as, “I need a lot of reassurance that [partner’s name] cares about me” and “I worry

**“It is almost as if a central component of passionate love is the fantasy that one will ultimately possess an attachment bond with the desired partner.”**

PAUL EASTWICK  
NORTHWESTERN UNIVERSITY

that [partner’s name] doesn’t care about me as much as I care about him/her.”

This uncertainty kept people interested. Participants were far more likely to date someone and to stay romantically focused on that person if they thought he or she liked them, but only if at the same time those participants experienced constant twinges of attachment anxiety.

These conflicting responses are precariously balanced in budding relationships, Eastwick says. One couple stopped dating after a couple of weeks because one person felt insufficiently desired by the other. Another breakup occurred after one person’s attachment anxiety toward the other had declined sharply for more than a week. In that case, one dater may have lost interest in another whose romantic intentions were no longer in doubt, Eastwick suggests.

For one couple that dated casually throughout the follow-up period, each person’s feelings of desirability and attachment anxiety ebbed and flowed, but both reactions were always present.

Fledgling daters who experienced attachment anxiety reported far more interest in forming a serious relationship than in having a one-night stand. People with troubled backgrounds, who generally felt anxious about their standing in any close relationship, usually didn’t contact their speed dating matches.

But for the vast majority of daters, partner-specific attachment anxiety accompanies romantic attraction and imbues unrequited love with its signature sense of wretched despair, the researchers suggest.

Some researchers believe that worries stirred up by budding relationships should not be called attachment anxiety, since actual, traditional attachment bonds have yet to form.

Eastwick demurs. “It is almost as if a central component of passionate love is the fantasy that one will ultimately possess an attachment bond with the desired partner,” he says.

### Feminine mystique

Evolution-minded psychologists regard women as more likely than men to want a committed relationship and to feel anxious about getting one. Because women have, since the dawn of humanity, faced much greater pressure to raise children, they have evolved to behave relatively cautiously and coyly with potential mates, according to these researchers. This tactic improves a woman’s chances of weeding out the users and the losers.

Men, on the other hand, are more apt than women to pursue short-term sexual relationships with many partners. Physical signs of a woman’s youth and beauty initially stand out for men. This perspective suggests that it is only after deciding to seek a long-term mate that men look beyond women’s surface qualities.

Consider a 2005 analysis of speed dating data, by psychologist Robert Kurzban of the University of Pennsylvania in Philadelphia. Men tended to choose to have further contact with every other woman they met. Women only wanted to meet again with one in three men.

Related evidence comes from a speed dating study in the January *Psychological Science*. Psychologist Peter Todd of Indiana University in Bloomington and his coworkers found that observers of speed dating encounters are moderately good at picking out who later expresses romantic interest in whom, with women being harder to read than men.

In Todd’s investigation, 28 female and 26 male college students who don’t speak German watched video clips of 24 speed dating interactions among German young adults. Clips lasted either 10 or 30 seconds and featured different parts of each speed date.



Observers correctly judged others' romantic interest in a partner about 60 percent of the time, a good but not great accuracy rate. "Some people hid their true intentions in this dating context, especially females," Todd says.

The true feelings of the female speed daters were harder to identify in general, and five women were nearly impossible for observers of either sex to figure out.

Observers judged speed daters' intentions best when viewing clips taken from the latter parts of encounters. Speed daters must have gathered information about each other throughout their brief interactions, making their intentions easier to read toward the end, Todd suggests. If so, then partners evaluate much more than each others' physical attractiveness during the few minutes of a speed date.

Nonetheless, men being men, they still focus on what women look like, even if unwilling to come right out and admit it. In a 2007 speed dating study, Todd and colleagues found that men and women alike said beforehand that their ideal mate possessed all sorts of physical and personal attributes that reminded them of their own. Yet men's choices of which women to contact after speed dates were, by admission on later questionnaires, based mostly on physical attractiveness.

Women were again the choosier sex. And each woman used judgments of her own physical allure to pick a few men having comparable desirability, based on a woman's perceptions of each man's wealth, status, family commitment, physical appearance and health. In other words, a woman's opinion of her own physical beauty determined what she aspired to in a partner. Women's self-perceived beauty lay behind their determinations of which men were good prospects.

Women become especially choosy given a large pool of prospects, picking only a few men ranked highly by nearly all female daters, Todd's group reports in January in *Animal Behaviour*.

Females in many nonhuman animal species do just the opposite, expanding their mating choices when faced with plentiful male options. In those situations, high-ranking males find it more

difficult to control low-ranking males' access to fertile females.

Speed daters play the mating game in a peculiarly human way, Todd proposes. Given only a handful of choices, women get less picky because they can evaluate many characteristics of each potential date. But faced with 20 or 30 alternatives, it's possible to track only a few obvious clues for each man, such as facial appearance and body type, narrowing the woman's pool of choices.

### Moving attractions

There's a simple and until now unexplored way to get female speed daters to lower their romantic standards, according to Finkel. Just have them move from one man to the next, rather than waiting for each man to approach them, as is the practice at virtually all speed dating events. "The mere act of physically approaching a potential romantic partner increases one's attraction to that person," Finkel says.

Finkel and Eastwick describe this phenomenon in a paper to be submitted for publication. Related research has already shown that individuals tend to feel more positively toward objects or people that they physically approach, versus those viewed from a stationary position.

At 15 speed dating events organized by the Northwestern University researchers, either men or women rotated from one partner to the next while the other sex remained seated.

When men approached and women sat, men reported far more romantic desire for their various partners than women did. Men also cited greater romantic chemistry with partners, relative to the seated women, and picked larger numbers of speed dating partners for further contact. But when women approached and men sat, the number of people men and women wanted to date was about the same.

Men are generally expected, if not required, to approach women in most situations that offer romantic opportunities, Finkel notes. This subtle social expectation may substantially explain why women are choosier daters than men.

In a related 2008 study, Finkel and Eastwick found no differences between

male and female speed daters' tendencies to favor partners with good looks or promising careers. Yet on questionnaires, the men had described a preference for physically attractive dates and women had emphasized a search for guys with good earning prospects.

"Purported sex differences in mating strategies have been touted as part of our evolved legacy, but that's a vastly oversimplified view," Utah's Diamond says.

Todd disagrees. Until other researchers confirm that women become less selective when told to approach prospective dates, he reserves judgment on Finkel and Eastwick's new study. The Northwestern researchers study college-aged daters, who may not exhibit clear sex differences in dating preferences because most seek short-term relationships, Todd notes.

His own speed dating studies include 20- to 50-year-olds. Todd regards members of this age group as the best bets for seeking a committed partner and showing sex-specific mating strategies.

However evolutionary scenarios pan out, speed dating offers an efficient tool for studying real-life love connections, remarks Columbia University economist Raymond Fisman. Dating websites and census data on marriages offer other avenues for such research.

These research approaches can help answer other questions about love, such as why some people experience no qualms about interracial dating while others do. Last year, a team led by Fisman reported that prevailing racial attitudes and racial diversity in people's home regions strongly influence their willingness to contact speed dating partners of other races. Fisman now investigates people's attitudes about organizational and corporate corruption. When considering either corruption or dating, he says, it's important to remember that people often lie both to themselves and others about their underlying motives. "We all tell ourselves comforting stories," Fisman observes. ■

### Explore more

- E. Finkel and P. Eastwick. "Speed-dating." *Current Directions in Psychological Science*. June 2008.

# The solar system's Big Bang

Finding signs of a lost beginning

By Ron Cowen

*Gone. Vanished. Lost.*

When it comes to the early history of the solar system, planetary scientists must contend with a case of nearly systemwide amnesia.

Although the solar system formed nearly 4.6 billion years ago, researchers have a pretty good record that goes back only 3.9 billion years. Yet those first 700 million years proved critical to all that followed. That's when the planets coalesced and water and other compounds essential to life were delivered to the inner planets.

What's more, according to a leading theory now being explored in detail, that early era was capped by a truly cataclysmic event. About 3.9 billion years ago, the movement of the most massive planets dramatically rearranged the outer solar system. The shifting planets freed rocky and icy bodies from the solar system's edge, commencing a bombardment of the entire retinue of planets.

Filling in the details of this violent era in the solar system's development has met

serious obstacles. On Earth and many of the other planets, billions of years of volcanic eruptions, quakes, erosion and burials have all but erased solid evidence of the solar system's earliest chapters. But Earth's crater-scarred moon, quiescent and lacking an atmosphere that could destroy incoming space debris, appears to be a rare and nearby exception.

Now new observations and reanalyses of old moon data, along with progress from theorists, have renewed interest in reconstructing the events of the solar system's preadolescence.

"If we don't understand the [earliest] years of the solar system, then we don't really understand how the planets formed, and where we came from," says Bill Hartmann of the Planetary Science Institute in Tucson. "And that applies to both biology and how planetary systems look, and what fraction of the plan-

ets [beyond the solar system] might be habitable."

Planetary scientists, says Bill Bottke of the Southwest Research Institute's Boulder, Colo., office, had initially conjectured that the solar system grew up in a hurry, "with everything you see today already in place just a few million years after the solar system's birth. But we're now considering the possibility that the solar system literally rearranged itself about 3.9 billion years ago."

At the Lunar and Planetary Institute in Houston last November, theorists and observers convened for a rare meeting in which they hashed out what each had gleaned about the solar system's early history. "We have two communities coming at the same problem from very different perspectives," says Don Bogard of NASA's Johnson Space Center in Houston.

At the meeting, the observers presented





new analyses of data first gathered nearly 40 years ago when the Apollo spacecraft landed on the moon and brought back moon rocks—one of the best preserved records of the solar system's tumultuous first 700 million years. Theorists presented their latest version of a theory that could account for several unexplained features of the solar system, including the violent era between 4 billion and 3.9 billion years ago known as the late heavy bombardment, when the planets were pelted with debris. And researchers reported evidence that if life had existed on Earth before that, the cataclysm might not have wiped out all organisms but could have spared primitive forms that thrived in hot, water-rich environments.

### Bombardment of data

Many of the new studies focus on events that gave the final touches to the

architecture of the solar system—events that took place just a few hundred million years after the planets had coalesced from the primordial disk of gas, dust and ice believed to have swaddled the infant sun. The planet-forming process probably took only a few tens of millions of years, and by 50 million to 60 million years after the birth of the solar system, the orbs had pretty much grown to their present size.

Hartmann says it's unclear whether the solar system suffered a high rate of bombardment by space debris continuously during its first 700 million years or whether activity suddenly spiked at the 700-million-year mark. But mounting evidence points to an abrupt lunar smack down. Several huge impact basins on the moon, dating to about 3.9 billion years ago, bear witness to this bombardment.

"When the Apollo astronauts brought

back samples, it was quickly realized that all the circular features up there were in fact impact craters," says David Kring of the Lunar and Planetary Institute. Moreover, the ages of a large variety of moon rocks date from 4 billion to 3.9 billion years ago. In addition, the rocks suggest the moon's crust underwent intense heating in the same time period.

The combined evidence prompted researchers to coin the phrase "lunar cataclysm" for the pummeling the moon apparently received.

Initially, some researchers worried that because all the Apollo craft, as well as the Soviet Luna missions, had landed in the same general area on the moon, the lunar samples collected could reveal what had happened only over a small region, about 4.5 percent of the lunar surface.

But that earlier criticism, Kring says, was superseded by a mother lode of lunar meteorites found in Antarctica in the 1990s. Those chunks of rock, presumably from all parts of the moon, showed the same time signature as the Apollo rocks, Barbara Cohen, now at NASA's Marshall Space Flight Center in Huntsville, Ala., and her colleagues found.

### Theory enters the act

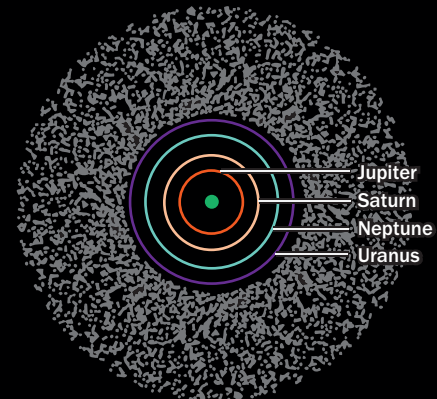
Early this decade, theorists Harold Levison of the Southwest Research Institute's Boulder office and his colleagues, including Alessandro Morbidelli of the Côte d'Azur Observatory in Nice, France, were puzzling over a different problem. They were trying to understand the formation and evolution of the outer solar system. The team's computer simulations showed that two of the planets plowed into a ring of icy leftovers from the planet-forming process, scattering the debris. This disruption and its aftermath, the researchers later realized, would have had a profound effect on the entire system.

At the Lunar and Planetary Institute meeting, Levison and Bottke presented the latest version of the theory, known



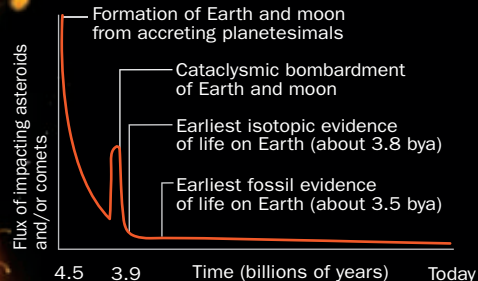
## Birth of a cataclysm

A simulation of the outer solar system's early evolution known as the Nice model tracks the planets' orbits from soon after the birth of the solar system through the period of late heavy bombardment and beyond. At the simulation's start, a massive reservoir of icy debris, a forerunner of today's Kuiper Belt, lies beyond the outer planets.



### 4.5 billion years ago

Early on, the four outermost planets follow circular orbits, packed closely together within a large disk of icy debris (shown in gray), leftovers from planet formation.



as the Nice model (*SN*: 5/28/05, p. 340) because of Morbidelli's contributions.

In the theory, the four biggest planets — Jupiter, Saturn, Neptune and Uranus — initially had sedate, circular orbits and were packed into a region only about half the diameter of Neptune's average modern orbit. Gravity then caused these bodies to spread out and break into a planetary version of bowling that not only violently rearranged the outer solar system but also led to an avalanche of debris pelting the inner planets and their moons.

Prompting this melee, scientists propose, was a series of gravitational interactions between the planets and the hefty disk of debris that lay just beyond. This disk, a forerunner of the Kuiper Belt, contained as much mass as 35 Earths.

For a while, not much happened. Jupiter moved slowly inward while the three other planets moved slightly outward. Then, at about 500 million to 600 million years after the birth of the solar system, Jupiter and Saturn hit a gravitational sweet spot, with Jupiter going around the sun twice for every orbit of Saturn.

In this configuration, known as an orbital resonance, the mutual gravitational influence of the two giants strengthened, elongating their orbits over time. The changed paths of Jupiter and Saturn eventually jumbled the orderly, circular orbits of the two lighter-

weight, outermost giants, Uranus and Neptune. And that's when all hell broke loose, Levison says.

Within a few million years, Uranus and Neptune were kicked so far out that they plowed into the surrounding disk of icy debris. Like bowling balls scattering pins, the two planets scattered the debris all over the solar system.

Some of the debris became trapped by Jupiter's gravity and could account for the planet's retinue of Trojan asteroids, a group of objects that lead and trail the planet today, and have not been explained by any other theory, says Levison.

Some of the scattered material traveled farther, penetrating deep into the inner solar system, the simulation suggests. It was this debris that pummeled Earth's moon during a geologically brief window of time that lasted only 100 million to 200 million years.

Indeed, this onslaught may well have generated the cataclysmic late heavy bombardment, in which Earth's moon and the inner planets were blasted with debris, Levison says. The cataclysm generated by the Nice model "is consistent with the magnitude and duration of the late heavy bombardment inferred from lunar craters," Bottke and his colleagues noted in an abstract from the meeting.

In this way, a fracas originally limited to the outermost regions ended up affecting the entire solar system.

Planetary scientists have recently

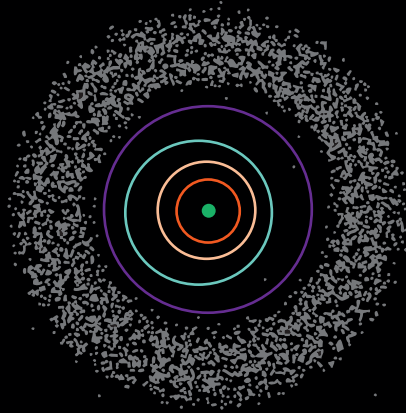
gathered evidence that the asteroid belt, located between the orbits of Mars and Jupiter, also took a direct hit during the late heavy bombardment. An analysis of meteorites believed to be fragments of Vesta, the second largest asteroid, reveal that they, too, suffered an intense bombardment about 3.9 billion years ago, Bogard notes. In addition, the famous Mars meteorite ALH84001, which dates from about 4.5 billion years ago and was once believed to contain fossils of nanobacteria, also shows signs that it suffered a major impact 3.9 billion years ago.

### All about zircons

But even on Earth, not all of this early history was erased, new research shows. The first era on our planet is called the Hadean period as in Hades, or hell. However, studies now show that this might not have been such the hellish period — impossibly hot and dry — that many researchers had imagined, says Stephen Mojzsis, a geochemist at the University of Colorado at Boulder.

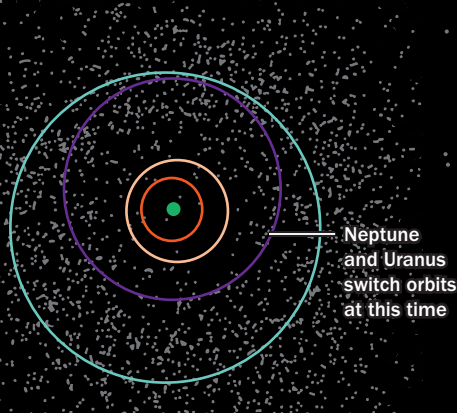
The clues come from ancient zircons — durable and chemically inert minerals that are remnants of Earth's first rocks.

Discovered about 25 years ago in the Jack Hills region of western Australia, the zircons are no bigger than the size of President Lincoln's eyeball engraved on a penny. They are up to 4.38 billion years old, predating by several hundred mil-



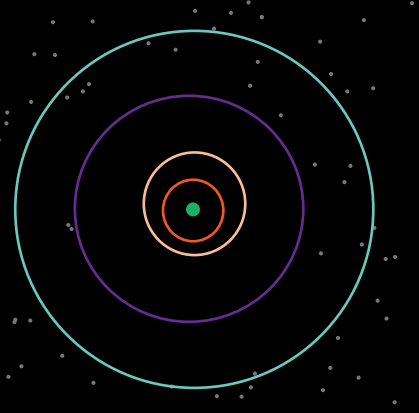
### 3.9 billion years ago

As the planets spread out, the orbits of Jupiter and Saturn fall into lock-step. Ultimately, the changed orbits of these two giants greatly alter the orbits of Neptune and Uranus.



### 3.9 billion – 3.8 billion years ago

Uranus and Neptune ram into the icy reservoir. The debris zooms into the inner solar system, where it catastrophically collides with the moon, Earth and the other planets (artist's depiction at far left).



### 3.65 billion years ago

The outer solar system settles into its current configuration. The impacts left behind on the moon are now providing clues to the history of the solar system.

lion years the era of the late heavy bombardment (*SN: 1/3/09, p. 10*).

“These zircons are our only [terrestrial] record keeper ... because Earth is constantly trying to recycle itself,” says Mojzsis. Withstanding weathering, erosion, burial, subduction and remelting, these hardy minerals are filling in a missing era of Earth’s early history when the crust, atmosphere and oceans were established, along with, perhaps, the very first biological systems.

The chemical information encoded in the zircons, says Mojzsis, suggests that Earth not only had crust during the Hadean, which some researchers had doubted, but that the crust was derived in part from granite. The formation of granite, he says, requires liquid water.

“The picture that’s now emerging about the early Earth, based on the analysis of about 100,000 grains from the Jack Hills area, is a watery world with more similarities than differences with today,” Mojzsis says. That means, he adds, that even in that early era, Earth may have possessed properties conducive to life.

Recent studies have revealed that the zircons have tiny zones, or mantles, about 2 to 4 micrometers across, which suggest the minerals were shock heated 3.96 billion years ago. That shock event may be evidence of the late heavy bombardment as it played out on Earth, Mojzsis says.

At the Houston meeting, he reported that such heating can best be explained

by a massive impact event that cauterized the outermost parts of the zircons over a matter of days. This kind of heat loss, he says, has only been seen in lunar rocks that have undergone shock heating.

Mojzsis and his colleagues are planning to reanalyze ancient zircons found in moon rocks, using tools that can resolve features 100 times finer than previously possible, to look for evidence that these lunar zircons were also shock heated.

All this feeds back into the Nice model. “The model is extremely powerful ... but it doesn’t tell us when the [late heavy bombardment] happened,” says Mojzsis. “That’s where people like me come along, to say, ‘Here is the time at which we see events consistent with the first wave of impactors.’”

The zircon studies on Earth provide “an emphatic no” to the question of whether the late heavy bombardment destroyed all life, he says. In recent simulations of Earth during Hadean times, Mojzsis and Oleg Abramov, also at the University of Colorado at Boulder, “have bombarded the crust with basically everything we could throw at it within reason, based on the Nice model and the lunar record,” Mojzsis says. “We cannot sterilize the Earth, even at 10 times the accepted bombardment rate” associated with the late heavy bombardment, he says.

The late heavy bombardment didn’t destroy organisms wholesale, “but it may have pruned the tree of life,” he says,

selecting for organisms that could survive high-temperature, hydrothermal environments. Indeed, many believe the oldest forms of microbial life “are things that live in hot spring environments, so-called hydrothermophiles,” he says.

To learn more about how the era of late heavy bombardment put the finishing touches on the assembly of the solar system, spacecraft will have to return to the moon, says Levison. A manned mission isn’t necessary, he says, but a robotic craft that can bring back rocks from regions of the moon not yet directly sampled will be essential to better probe the solar system’s early history. Under President George W. Bush, NASA was directed to head back to the moon with both robotic and manned missions, but the fate of that program is now uncertain.

“I think the next few years is going to be a lot like the years preceding the Apollo program, when money was spent to educate people about what was going to happen in July 1969 but also to prepare the laboratories and invest in new techniques,” Mojzsis says. “We have a huge collection of [lunar] Antarctic meteorites at NASA, and I plan to investigate those until we get samples back from the south pole of the moon.” ■

### Explore more

■ Read more about the late heavy bombardment at [www.psrhawaii.edu/Aug06/cataclysmDynamics.html](http://www.psrhawaii.edu/Aug06/cataclysmDynamics.html)

## Dry Storeroom No. 1: The Secret Life of the Natural History Museum

Richard Fortey

**M**useums are more than collections of art and artifacts: They're collections of the people who work there.

In *Dry Storeroom No. 1*, paleontologist Richard Fortey provides a behind-the-scenes look at London's Natural History



Museum, a fascinating account that's less a history of the institution and more an intimate chronicle of the achievements, the hopes and frustrations, and the virtues and failings

of the scientists who strive to bring the museum's collections to life. The book takes its title from a long-neglected room that Fortey discovered in the museum's basement—a musty storeroom chock-full of tortoise shells, stuffed fish and remnants of exhibits.

The room serves as a metaphor for the half-forgotten memories and untold stories of countless curators.

Scouring the world to collect, describe and name the world's species is just a small part of the job, Fortey notes. One museum scientist's knowledge of screw-worms helped stop an outbreak among cattle in Africa dead in its tracks—an outbreak that might have devastated much of the continent's wildlife.

Vital contributions can take odd forms: One expert in cryptogams (a type of plant) was mistakenly assigned to the Ministry of War during World War II because he was thought to be an expert at breaking codes (cryptograms). He nevertheless aided the war effort because he knew how to preserve water-soaked notebooks that had been recovered from captured U-boats.

Although Fortey notes these stories are peculiar to his museum, similar tales have likely unfolded at dozens of others around the world. —*Sid Perkins*  
*Alfred A. Knopf, 2008, 335 p., \$27.50.*

## The Inner History of Devices

Sherry Turkle, ed.

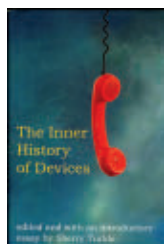
**C**ell phones, cyberspaces and video poker are not just functional technologies. And prosthetic eyes, dialysis machines and defibrillators are not simply medical tools. When people become intimately attached to technology, technology becomes imbued with personal meanings.

In this series of essays, anthropologists, psychologists and others share stories that attempt to address two profound questions: Do the machines and devices we use serve our purposes? And do the machines and devices change our purposes?

"What we have made is woven into our ways of seeing and being in the world," writes Turkle, founder and director of MIT's Initiative on Technology and Self.

The most powerful tales in the book address how people perceive and control their bodies. One writer discusses her relationship with her prosthetic eye:

"I have come to think of my imperfect body as I think of my grandmother's 1966 Ford Falcon. I have a certain loving acceptance that its shortcomings are just part of what it is." Another deals with the science fiction of internal cardiac defibrillators: "How do



the jolts of the ICD—traumatic biotechnological interventions—change the lives they seek to prolong? How do they change the deaths they attempt to postpone?" Others address how avatars help patients self-reflect, how virtual dissection changes medical education and how Slashdot.org gives addiction a good name.

Though sometimes intimate and sometimes absurd, these essays will make you think about what it means to be human in a technology-infused world. —*Elizabeth Quill*

*MIT Press, 2008, 208 p., \$24.95.*



## Blessed Days of Anaesthesia: How Anaesthetics Changed the World

Stephanie J. Snow

An account of the early pain-dulling and sensation-killing drugs and their effects on society. *Oxford, 2008, 226 p., \$34.95.*



## Urban Ants of North America and Europe: Identification, Biology and Management

John Klotz, Michael Rust,  
Reiner Pospischil and  
Laurel Hansen

A guide for rapidly identifying these pests, and for beginning to develop plans to control them. *Cornell Univ., 2008, 196 p., \$27.95.*



## A Very Improbable Story

Edward Einhorn and  
Adam Gustavson

A cat named Odds plays games of probability with a young boy in this children's book. *Charlesbridge, 2008, 32 p., \$16.95.*



## CO<sub>2</sub> Rising: The World's Greatest Environmental Challenge

Tyler Volk

A biologist explains the carbon cycle. *MIT Press, 2008, 223 p., \$22.95.*



## The Great Equations: Breakthroughs in Science from Pythagoras to Heisenberg

Robert P. Crease

An examination of the power and beauty within discrete symbolic statements. *W.W. Norton & Company, 2009, 315 p., \$25.95.*

**How to Order** To order these books or others, visit [www.sciencenews.org/bookshelf](http://www.sciencenews.org/bookshelf). A click on a book's title will transfer you to Amazon.com. Sales generated through these links contribute to Society for Science & the Public's programs to build interest in and understanding of science.



## Goodbye structures

Though it is extremely regrettable and unfortunate that plastic museum artifacts are degrading (“Long live plastics,” *SN*: 11/8/08, p. 34), the ultimate demise of these pop polymers will not have dire consequences. The same statement can’t be made for all of the plastics that have gained common usage in the construction industry since the 1970s.

Plastics abound in modern construction. Many plastic items are sequestered in hidden places. PVC drain and vent pipes, Styrofoam and other types of plastic insulation, vinyl window frames, insulation on wiring, lighting panels and lamp globes—the list is extensive. When these plastics begin to degrade, what will be the effect on our quality of life and our economy? I’m rather gratified that I live in a ’60s house with copper plumbing and fiberglass insulation. My window frames are wood and metal. One concession to plastification is the vent-

ing system for a high-efficiency furnace. At least the pipe is visible so degradation is available to inspection. I have to wonder, though, about the piping in all those more modern buildings.

**Dixie Luoma**, New Brighton, Minn.

## Don’t lose the notebook

Regarding “Many drug trials never published” (*SN*: 12/20/08, p. 14), the scientific method includes the tradition of carefully recording observations in ink in a bound lab notebook so they can’t be altered and must be considered in entirety. It is sad that some “experts” follow the common misunderstanding of the method by repeating experiments and presenting only what they want.

**Don Burnap**, Rapid City, S.D.

## Cannibalism’s many benefits

In the article “Cannibals have better babies” (*SN*: 11/22/08, p. 14), Susan Milius discusses one reason for canni-

balism: high-quality prey. Once spiders have mated, the priority of the female would naturally shift to the survival, and health, of herself and her young. These spiders live in an arid environment with a limited food supply. The males are almost as large as the females and would presumably eat as much. By consuming these late-arriving males, females would not only obtain a “nutritional boost” but would also eliminate a large competitor for the available food supply. The female would also have the added benefit of reducing the chances of successful mating for other females in the area. Fewer competing young would increase the odds of her young prospering.

**William C. Landis**, Lancaster, Pa.

## Send communications to:

Editor, Science News  
1719 N Street, NW  
Washington, D.C. 20036  
or [editors@sciencenews.org](mailto:editors@sciencenews.org)  
All letters subject to editing.



# Better Hearing Made Easy

## Get the world’s first disposable hearing aid

If you or your loved one has mild to moderate hearing loss, the all-new Songbird® flexfit™ is the ideal solution. Easy and affordable, it offers a revolutionary alternative to costly traditional hearing aids. Use it only when you need it, just like reading glasses. Adjustable for a personal fit, it’s perfect for those who want to improve hearing on their own terms—without sacrificing quality or comfort.

## Improve your hearing without hassle or major expense

- Crystal-Clear Digital Sound Quality
- Lasts for 400 Hours of Active Use\*
- No In-Office Fittings or Maintenance
- No Batteries to Replace
- Order from Home—Call Now!

**You may not always need help hearing.  
For the times you do, trust Songbird.**

\*Under typical use patterns, battery lasts for 400 hours of active use (when turned on). Make sure to turn the device off when not in use to maximize battery life. †Less shipping and handling. The Songbird flexfit™ disposable hearing aid is for mild to moderate hearing loss. Not intended for use by anyone under 18 years of age. Hearing loss can be a symptom of a medically treatable condition. Consult your doctor prior to using any hearing aid.

Ad provided by MediaBids.com. 1-866-236-2259.

**100% Satisfaction Guaranteed**



**ASK HOW TO GET FREE SHIPPING!**

Not available in stores  
**Try It Now Risk-Free†**  
**Call 1-877-492-8907**



Compact design  
as shown in hand



Product worn as shown—  
hides discreetly behind the ear

PR07220835

# Lonnie Thompson



For more Comment, visit COLUMNS at [www.sciencenews.org](http://www.sciencenews.org)

## Receding glaciers erase records of climate history

**F**or three decades, Lonnie Thompson of Ohio State University has been monitoring the health of glaciers atop mountains from Peru to China. Skeptics initially doubted that he could retrieve meaningful data from these remote elevations. But he has, while also discovering that these millennia-old data-storage lockers are rapidly disappearing. Senior Editor Janet Raloff recently spoke with Thompson about what science is losing.

### When did you first learn high-elevation glaciers were dying?

When we started our monitoring program in 1978, people typically described the movement of ice fields as slow — you know, glacial. But in the early '90s during repeated visits to Peru's Quelccaya glacier, the largest tropical ice cap on Earth, we realized it was in rapid retreat. Although 168 meters thick at the top, it's now retreating up the mountainside by about 18 inches a day, which means you can almost sit there and watch it lose ground.

Mount Kilimanjaro in Tanzania has lost 84 percent of its ice since 1912. As of our 2007 measurements, it was down to 2 square kilometers. And even that measurement is deceptive because it's not only losing area but depth. In some places, it may only be a half-meter thick.

### How unusual is the warming that these glaciers are experiencing?

Whether you're looking at glaciers in the Andes of South America or in the Himalayas, you see a similar trend. The whole atmosphere is warming in the tropics. But the greatest warming is taking place at the highest elevations — on the order of 0.3 degrees C per decade.

### From a science perspective, what's so special about these glaciers?

Weather stations are located where people live — in mountain valleys and

other lower-elevation regions. They're not on glaciers where long-lived ice is around to capture and store pollen, pollutants and isotopic anomalies reflecting seasonal temperature variations.

Ice masses on the tops of mountains — sticking out in the free atmosphere — have been collecting climate data and storing them, in many cases for very long periods. One ice core from Mount Kilimanjaro contains climate data going back 11,700 years, far longer than any documented history.

Data from tropical glaciers offer information about how vegetation has changed in the past; the history of El Niños — their intensity, magnitude and periodicity; how monsoons have varied through time; even dust data reflecting the duration of major droughts.

Although glaciers in some polar regions may be healthy, the climate that's important to people is the climate where they live. And these tropical glaciers represent a history of climate in areas of human civilization.

### How robust are those climate data?

Glaciers record the deposition of snow in annual layers. They're like tree rings. One can calibrate the age of glaciers by identifying layers of ice that record a common event for which the date is known, like fallout from thermonuclear bomb testing. For a long time, the signature of bomb tests was evident in all ice cores. But in 2006 we were taken aback by analysis of ice cores that we drilled on the Tibetan Plateau.... There was no isotope signature recording bomb tests during the early 1950s and '60s.

Those data had been really useful because they validated a timeline. They allow you to calibrate ice-accumulation rates, when dust and certain chemical changes occurred, or oxygen-isotope data suggesting temperature variations.

The loss of the bomb signature also signaled another important change: the loss of mass not only at the margins of a glacier, but also in depth — from the surface down.

So relatively recent climate history is disappearing. But that history starts to degrade long before the ice is gone. We've seen that as soon as melting occurs on an ice field — which at

Quelccaya was 1991 — water begins to move vertically through the porous surface, taking with it climate residues. This meltwater eliminates annual signals. And this compromises its historical value.

### Who will suffer from its loss?

Certainly climate scientists. But plenty of others as well. More than 600,000 people died in 1792 because of droughts associated with a major monsoon failure in India. What appears to be a 300-year drought beginning 4,186 years ago brought an end to Egypt's first kingdom — when the pyramids were built — and led to mass starvation and migrations. Signatures of the dust from those events appear in the ice record.

These data offer perspective on how serious and long-lasting the impacts of natural climate have been. I think we can learn powerful lessons from that relationship between climate and the rise or fall of civilizations — lessons that might help us in the 21st century. ■



**These tropical glaciers represent a history of climate in areas of human civilization.**





© 2009-2008 Imagine/PhotoDisc.

# How Do Our Minds Form Language?

You use language every day to express your thoughts, your ideas, and your opinions. But what are the rules of language? And how can knowing them enhance your experience of the world?

**Understanding Linguistics: The Science of Language** is your opportunity to journey through the fascinating world of linguistics. In these 36 lectures, you explore the field of scientific linguistics, investigate the critical elements of language, and encounter the great minds who have influenced our understanding of them. An acclaimed linguist, media commentator, and author, Professor John McWhorter makes the process of understanding linguistics intensely rewarding. He provides you with invaluable insights you'll find surfacing whenever you experience language around you.

This course is one of The Great Courses®, a noncredit recorded college lecture series from The Teaching Company®. Award-winning professors of a wide array of subjects in the sciences and the liberal arts have made more than 250 college-level courses that are available now on our website.

## Understanding Linguistics: The Science of Language

Taught by Professor John McWhorter, Manhattan Institute

### Lecture Titles

1. What Is Linguistics?
2. The Sounds of Language—Consonants
3. The Other Sounds—Vowels
4. In the Head versus On the Lips
5. How to Make a Word
6. The Chomskyan Revolution
7. Deep Structure and Surface Structure
8. The On-Off Switches of Grammar
9. Shades of Meaning and Semantic Roles
10. From Sentence to Storytelling
11. Language on Its Way to Becoming a New One
12. Recovering Languages of the Past
13. Where Grammar Comes From
14. Language Change from Old English to Now
15. What Is an Impossible Language?
16. How Children Learn to Speak
17. How We Learn Languages as Adults
18. How You Talk and How They Talk
19. How Class Defines Speech
20. Speaking Differently, Changing the Language
21. Language and Gender
22. Languages Sharing the World—Bilingualism
23. Languages Sharing a Sentence—Code-Switching
24. The Rules of Conversation
25. What Is This Thing Called Language?
26. Speech as Action
27. Uses of Talk from Culture to Culture
28. Does Language Channel Thought? The Evidence
29. Does Language Channel Thought? New Findings
30. Is Language Going to the Dogs?
31. Why Languages Are Never Perfect
32. The Evolution of Writing
33. Writing Systems
34. Doing Linguistics—With a Head Start
35. Doing Linguistics—From the Ground Up
36. The Evolution of Language

Order Today!  
Offer expires Thursday, April 16, 2009

Understanding Linguistics: The Science of Language  
Course No. 2270  
36 lectures (30 minutes/lecture)

DVDs

~~\$374.95~~

**NOW \$99.95**

+ \$15 Shipping, Processing, and Lifetime Satisfaction Guarantee

Priority Code: 32736

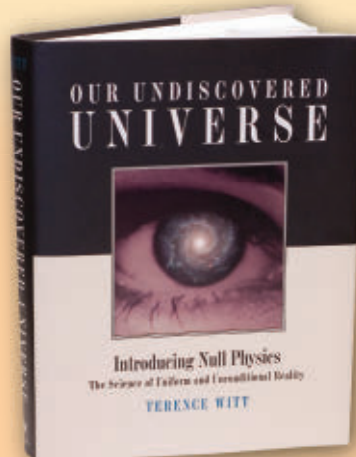
**1-800-TEACH-12**  
**www.TEACH12.com/3sn**

ACT NOW!

[www.OURUNDISCOVEREDUNIVERSE.com](http://www.OURUNDISCOVEREDUNIVERSE.com)



# YOU WON'T



Available for Purchase at

[www.OURUNDISCOVEREDUNIVERSE.com](http://www.OURUNDISCOVEREDUNIVERSE.com)

Retail \$59 ©Aridian Publishing Corporation (877) 274-3426