Clever Crows | Seismic Clairvoyance | Moody Visions

$3.95 U.S. | www.sciencenews.org

ScienceNews

MAGAZINE OF THE SOCIETY FOR SCIENCE & THE PUBLIC ■ AUGUST 29, 2009

Not so Great Lakes

They Were Once Merely Big Ponds

Baby Stars From Green Peas

Sly Fungus Outfoxes Ants

Tiny Swimmers' Oceanic Impact

Special Offer*

Receive $200 in Stauer Gift Coupons 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 coupons!

Better 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 Diamond*Aura*® ***French Pear Drop Pendant*** Necklace for $195, you'll receive two $100 Stauer gift coupons. 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. Diamond*Aura*® 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 Diamond*Aura*® pendant larger than 2 ¾ carats. Today we release the ultra-luxury, majestic lab-created Diamond*Aura* pendant with stunning clarity, cut and color rarely seen. Our Pendant features a 5 carat, pear-cut Diamond*Aura* that dangles from an 18" chain of the finest .925 sterling silver. The pear is topped with an impressive 1 carat marquise-cut Diamond*Aura* bail.

The Four Cs. Our exclusive Diamond*Aura* jewelry has splendid specifications: color, clarity, cut, and carat weight. We won't bore you with the details, but we've invested close to $6 million in developing Diamond*Aura*. 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.

Compare For Yourself at 6 carats		
	Mined Flawless Diamond	Diamond*Aura* 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+	$195

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 Diamond*Aura* ***French Pear Drop Pendant***, return it within 30 days for a refund of your purchase price. Our Diamond*Aura* will last forever, but our **limited edition** will not. Call today to take advantage of this offer.

JEWELRY SPECS:
- 5 carat pear-cut center Diamond*Aura*®
- 1 carat marquise-cut Diamond*Aura*® *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 Coupons 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.

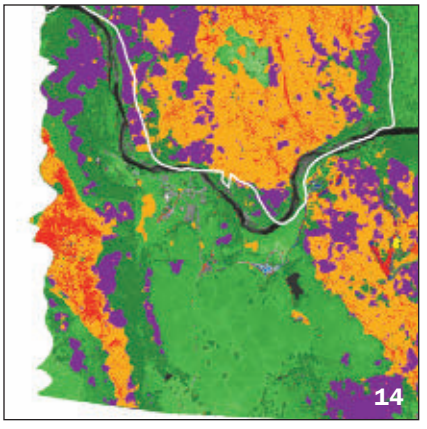
1-800-721-0386

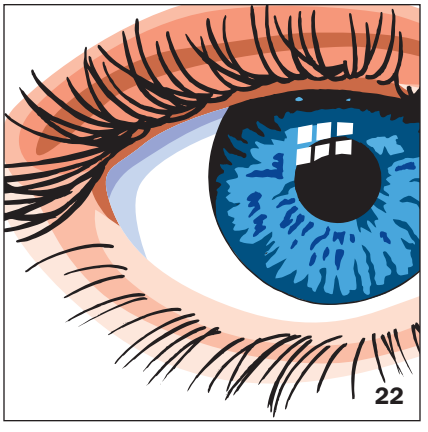
Promotional Code PDN197-03
Please mention this code when you call.

Stauer
14101 Southcross Drive W.,
Dept. PDN197-03
Burnsville, Minnesota 55337
www.stauer.com

Smart Luxuries—Surprising Prices

AUGUST 29, 2009 • VOL. 176 • NO. 5





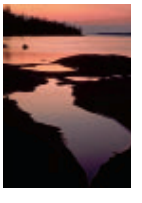
HUMMINGBIRD: LUIS MAZARIEGOS

ScienceNews

In The News

Features

Departments



COVER Today's Great Lakes are magnificent (Lake Superior's Isle Royale National Park shown), but they were smaller and disconnected in ancient times. *David Muench/Corbis*

ScienceNews MAGAZINE OF THE SOCIETY FOR SCIENCE & THE PUBLIC

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* Erika Engelhaupt

astronomy Ron Cowen
behavioral sciences Bruce Bower
biomedicine Nathan Seppa
earth sciences Sid Perkins
environment/chemistry Rachel Ehrenberg
life sciences Susan Milius
molecular biology Tina Hesman Saey
staff writer Laura Sanders
editorial assistant Rachel Zelkowitz
web specialist/editorial secretary Gwendolyn K. Gillespie
science writer intern Jenny Lauren Lee

DESIGN
assistant art directors Joshua Korenblat, Avik Nandy

ADVERTISING | CIRCULATION
advertising manager Judy Lewis *West, Midwest & DC Metro*
circulation manager Tosh Arimura
account executives Gregg Oehler, Rich Cordero, *Oehler Media, East;* Rick Johnson, *National Brands*
advertising/circulation assistant Kerwin Wilson *permissions* Evora Swoopes

EDITORIAL, ADVERTISING AND BUSINESS OFFICES
1719 N Street NW, Washington, DC 20036 · Phone (202) 785-2255
Audit Bureau of Circulations
Subscriptions subs@sciencenews.org · ***Editorial/Letters*** editors@sciencenews.org
Advertising/Business snsales@sciencenews.org
Texterity Digital edition provided by Texterity, www.texterity.com
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.

FROM THE EDITOR

Earthquakes severely test science's power to predict

In the ancient world, natural phenomena provided shock and awe (still unmatched by the modern non-nuclear military) at the extremes of violence and serenity.

Earthquakes, on the one hand, displayed terrifying destructive power. Evoking equal terror were solar eclipses, which disrupted the normal rhythm of dark and light, but with no discernible consequences. Though at opposite ends of the powerful-peaceful spectrum, quakes and eclipses in the prescientific era had one thing in common besides being terrifying — both occurred without warning.

As science dawned, though, eclipses were among the first of nature's mysteries to succumb to math's power to render the physical world explainable. Regularities in the heavens, captured quantitatively, permitted accurate predictions of where and when eclipses would occur. No other example verified more clearly the power of science to turn terror into entertainment.

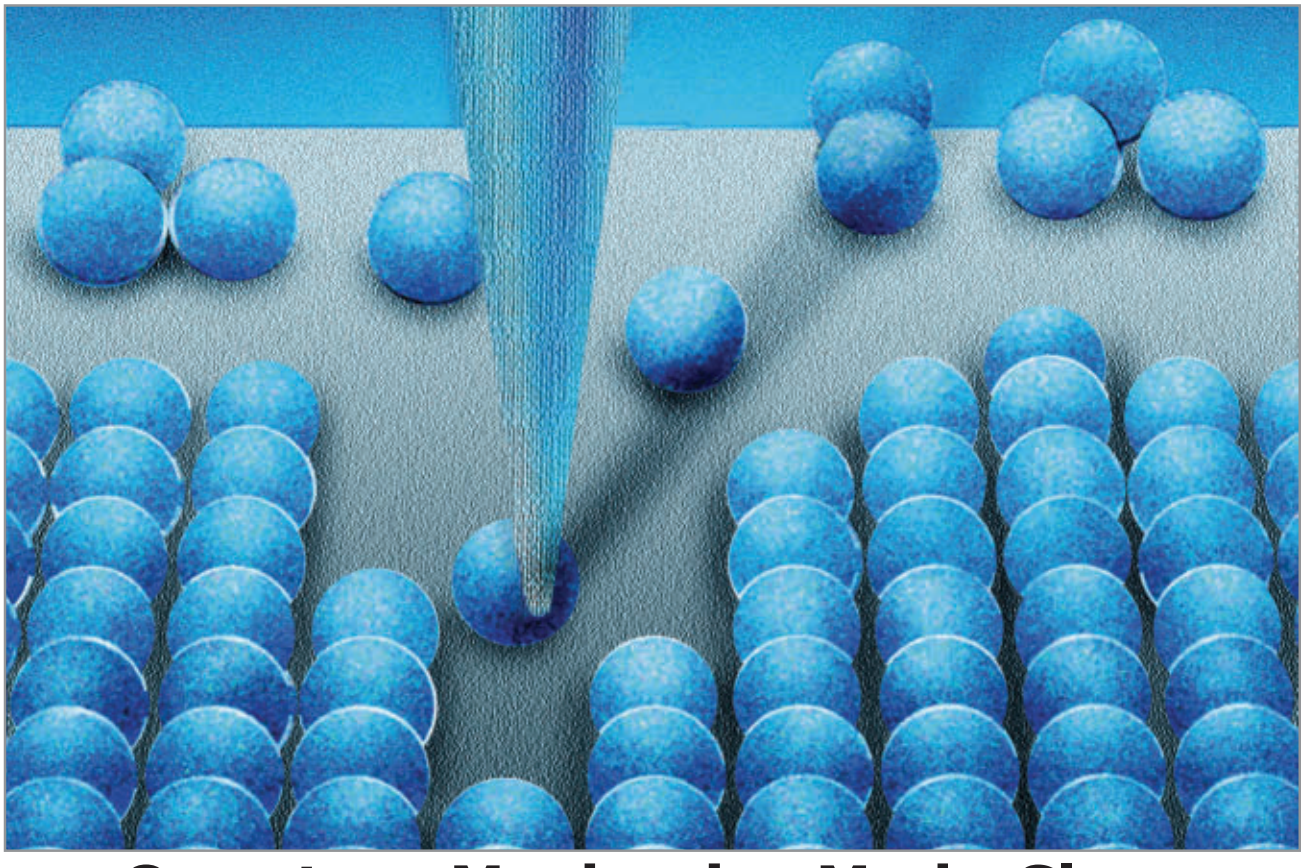
Earthquakes, though, defy prediction to this day. Efforts by geoscientists to find reliable short-term warning signs of ruptures in the Earth's crust have been no more successful than attempts to build perpetual motion machines, find Jimmy Hoffa or make money from cold fusion.

Yet the quest continues, as Kristina Bartlett Brody explains in her report in this issue (Page 26). A growing number of geophysicists and seismologists believe that mathematical methods might still someday succeed in identifying patterns in the timing of major quakes.

Like doctors seeking ways to forecast the onset of deadly illnesses, seismologists hope to anticipate the arrival of "strange eruptions" breaking forth from "diseased nature" to topple steeples and towers, as Shakespeare described in *Henry IV, Part 1*. A deeper understanding of the small, slow and imperceptible temblors generating an everlasting background of seismic activity may very well reveal clues to the processes that produce the Big Ones. Someday.

For now, though, it is much easier to figure out what happened to the Earth thousands of years ago — when the Great Lakes were simply pretty big ponds (see Page 18) — than to predict where a strange eruption will occur even next year.

— Tom Siegfried, Editor in Chief



Quantum Mechanics Made Clear

In its relatively short history, quantum mechanics has radically changed our perspective on reality and has come to play a critical role in today's most important technologies. Now, discover astonishing insights into this remarkable field with **Quantum Mechanics: The Physics of the Microscopic World**.

Award-winning Professor Benjamin Schumacher—a founder of quantum information theory and a fellow of the American Physical Society—introduces you to the complex phenomena of quantum mechanics in a way that is both enlightening and easily accessible. Generously illustrated with diagrams, demonstrations, and experiments, these 24 fascinating lectures are a great way to master the secrets of this extraordinary discipline.

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 300 college-level courses that are available now on our website.

Quantum Mechanics: The Physics of the Microscopic World

Taught by Professor Benjamin Schumacher, Kenyon College

Lecture Titles

1. The Quantum Enigma
2. The View from 1900
3. Two Revolutionaries—Planck and Einstein
4. Particles of Light, Waves of Matter
5. Standing Waves and Stable Atoms
6. Uncertainty
7. Complementarity and the Great Debate
8. Paradoxes of Interference
9. States, Amplitudes, and Probabilities
10. Particles That Spin
11. Quantum Twins
12. The Gregarious Particles
13. Antisymmetric and Antisocial
14. The Most Important Minus Sign in the World
15. Entanglement
16. Bell and Beyond
17. All the Myriad Ways
18. Much Ado about Nothing
19. Quantum Cloning
20. Quantum Cryptography
21. Bits, Qubits, and Ebits
22. Quantum Computers
23. Many Worlds or One?
24. The Great Smoky Dragon

Order Today!
Offer Expires Wednesday, October 28, 2009

ACT NOW!

Quantum Mechanics: The Physics of the Microscopic World
Course No. 1240
24 lectures (30 minutes/lecture)

DVDs ~~$254.95~~ **NOW $69.95**
+ $10 Shipping, Processing, and Lifetime Satisfaction Guarantee

Priority Code: 33331

1-800-TEACH-12
www.TEACH12.com/8snt

THE TEACHING COMPANY®
The Joy of Lifelong Learning Every Day™
GREAT PROFESSORS, GREAT COURSES, GREAT VALUE GUARANTEED.™

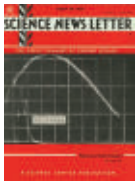
Scientific Observations

"In talking about science, whether to the public or to students, we scientists often assume that they share with us a common idea of science. In my experience that is often not the case. To oversimplify, scientists think of science both as a process for discovering properties of nature and as the resulting body of knowledge, whereas most people seem to think of science, or perhaps scientists, as an authority that provides some information —just one more story among the many that they use to help make sense of their world."

THEORETICAL PARTICLE PHYSICIST HELEN QUINN OF SLAC NATIONAL ACCELERATOR LABORATORY IN THE JULY *PHYSICS TODAY*

Science Past | FROM THE ISSUE OF AUGUST 29, 1959

FETAL SEX STILL UNKNOWN — Expectant mothers still face the ancient and perplexing problem of whether to knit blue or pink booties, despite the advances of this scientific age. Although scientists appear to be near to perfecting a reliable method of predicting the sex of unborn babies, the present "wait and see" policy remains the best. One of the latest scientific methods ... involves analyzing the amniotic fluid of the pregnant woman. No claims have yet been made as to its accuracy.... The persistent belief that the male baby would be brighter or stronger or more active during pregnancy dominated the thinking of people down through the ages. Even today there is the saying that an active fetus will be a boy.

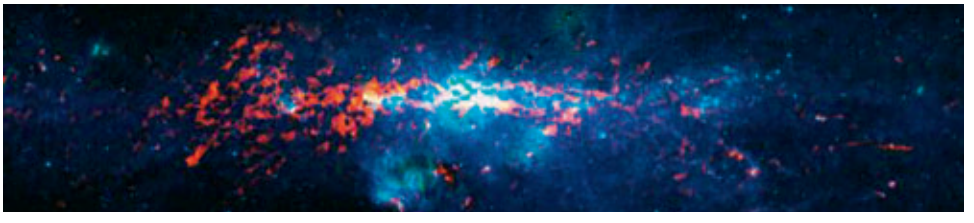


Science Future

September 29
MESSENGER spacecraft expected to make its third and final flyby of Mercury. Learn more at messenger.jhuapl.edu

October 4–10
Celebrate World Space Week. Find local events and activities at www.worldspaceweek.org

October 18–21
The Geological Society of America hosts its annual meeting in Portland, Ore. Visit www.geosociety.org/meetings/2009



The (-est)

Astronomers unveiled on July 1 the largest map of cold dust in the Milky Way galaxy, providing researchers with new clues about stars' likely birthplaces. The map covers a region along the plane of the galaxy about 2 degrees wide—four times the apparent diameter of the full moon—and about 40 degrees long. The map was compiled from images taken by the submillimeter APEX telescope in Chile and depicts the glow from dust clouds near the center of the Milky Way (portion of map shown) and across the galaxy. Because stars are born within cold cocoons of gas and dust, the clumps show sites of possible star formation.

CLOCKWISE FROM TOP LEFT: DIANA ROGERS; APEX/ESO, MIDCOURSE SPACE EXPERIMENT, INFRARED PROCESSING AND ANALYSIS CENTER/NASA

SN Online

www.sciencenews.org

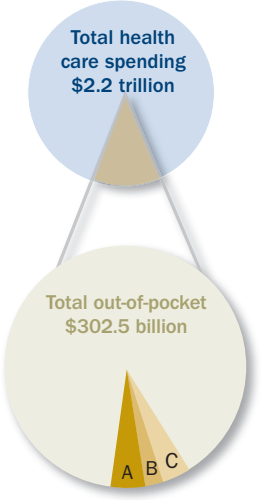
ATOM & COSMOS
The Large Hadron Collider will switch on again at half power this November. See "Half the boom better than no boom at all."

MATTER & ENERGY
With enough pressure, light reveals its speed in mixed materials. See "Putting the pressure on light."

BODY & BRAIN
Another version of the virus that causes AIDS has been identified. Read "New HIV–1 group."

Science Stats

Alternative health care costs
Proportion of U.S. health care dollars spent on complementary and alternative care in 2006



Total spending: Complementary and alternative medicine
$33.9 billion

A Practitioner visits
$11.9 billion

B Yoga, tai chi, qi gong, homeopathy, relaxation, etc.
$7.2 billion

C Natural products
$14.8 billion

SOURCES: 2007 NATIONAL HEALTH INTERVIEW SURVEY, CENTERS FOR MEDICARE AND MEDICAID SERVICES

“Timing is a really important issue when you want to fight pathogens or heal after an injury.” — MIKAEL PITTET, PAGE 10

In the News

STORY ONE

Crows use sticks, stones to show skills at manipulating tools in lab

Birds’ problem-solving ability turns out to be no fable

By Bruce Bower

Crows have an unspoken motto: Sticks and stones may break my bones, but they sure can come in handy. Two new studies unveil the ability of at least some crows to use tools in sophisticated ways, without training, to obtain food.

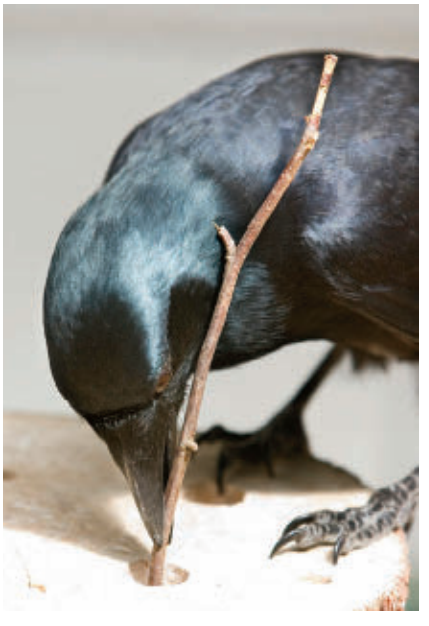
Crows’ problem-solving feats in these studies underscore a substantial intelligence that has attracted relatively little scientific attention, according to both research teams.

Scientists have previously noted tool use among members of the crow family, or corvids, including dropping stones on intruders or prey and using paper as a rake and sponge. But few birds outside this family display comparable behavior, and researchers have largely concentrated on the extensive, flexible tool practices of chimpanzees and other nonhuman primates. Evidence from apes and monkeys, as well as other large-brained, social animals such as dolphins, has debunked the traditional view that tool use is a defining human characteristic.

In one study, appearing in the Aug. 25 *Current Biology*, zoologists Christopher Bird of the University of Cambridge in England and Nathan Emery of Queen Mary, University of London report that captive rooks — members of the crow family — rapidly learn on their own to use stones to obtain food. The rooks dropped stones into a tube containing water in order to raise the water level and bring a floating worm within reach. This behavior recalls one of Aesop’s fables, in which a thirsty crow plunked rocks into a pitcher to raise the water level high enough for a drink.

All four rooks tested used stones provided by the researchers to raise the water level. Two birds succeeded on their first try. The other two needed two tries.

In all successful cases, birds put in only the number of stones needed to snatch the worm. Most of the time rooks did not begin by dropping the biggest stones into the water, but the birds quickly learned to do so. The four rooks also rapidly figured out the futility of dropping stones into a tube containing sawdust with a worm on top.



SIMON WALKER

Uék, a New Caledonian crow, uses a twig to probe for insects. A new study finds that he and other crows can master three-step tool use without training.

Although no evidence indicates that rooks use tools in the wild, the animals possess general mental abilities that they can apply to tool use, Bird and Emery propose. These include insights about physical rules, such as water in a container rising after a stone gets dropped in. In the team’s view, such insight fostered the birds’ success in the new study.

“Rooks do not use tools in the wild because they do not need to, not because they can’t,” Bird says. They get everything they need in their natural habitat without having to resort to devising tools.

In a comment accompanying Bird and Emery’s study, Alex Taylor and Russell Gray, both researchers at the University of Auckland in New Zealand, note that the birds don’t have to have a plan in mind when they begin the task. The rooks in the study had already learned on their own to drop stones into a tube in order to collapse a platform inside and release food. Based on that experience, crows could have decided right away to try dropping a stone into the water-filled tube. After seeing the water rise and the worm move closer, birds would have added more stones.

Other researchers reported in 2007 that, in similar fashion, orangutans collected water from a drinking container in their mouths and then spat into a tube to raise the water level so that they could

For today's top stories, visit
SN Today at **www.sciencenews.org**

snatch a peanut floating on the surface.

It's unclear whether orangutans and rooks devise a mental plan before acting or simply have the capacity to notice when a random act causes food to move closer and then repeat the act, comments experimental psychologist Amanda Seed of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany.

In a paper published online August 4 in *PLoS ONE*, zoologist Joanna Wimpenny of the University of Oxford in England and her colleagues report that captive New Caledonian crows can manipulate three wooden sticks, one at a time and in the correct sequence, to obtain food. Three-step tool use didn't require, but was enhanced by, earlier training with the sticks.

New Caledonian crows have been shown to modify twigs and leaves to remove insects from crevices in the wild (*SN: 3/22/03, p. 182*). In earlier work directed by Oxford's Alex Kacelnik, a New Caledonian crow bent or unbent strips of metal as needed to reach pieces of food.

Five of seven crows in the new study managed on their own to grab an available, short stick with their beaks, use it to drag a longer stick from a transparent tube and then pull food out from another tube with the longer stick. Four crows succeeded on the first trial.

Further testing showed that four crows, including one that had no prior experience with the experimental set-up, frequently used three sticks in correct sequence to obtain food. Birds used a short stick to drag a longer stick out of a tube, and used the longer stick to drag an even longer one from another tube. The birds could reach the food only with the longest stick.

In a new study, rooks such as this one dropped stones into a water-filled tube to increase the water level and nab worms floating on the surface.

Each crow committed its own pattern of errors in performing the three-tool task. Crows perceived food depth and tool length with varying degrees of accuracy, leading to a range of errors, the researchers hypothesize.

"Crows made errors that would not be expected if they had full knowledge of the requirements of the task and an ability to plan a complete sequence of novel actions, but critically, it was not possible to say which ability was lacking," remarks Seed.

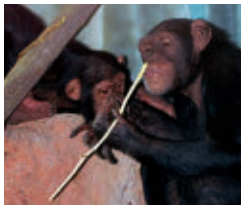
Whatever the case, New Caledonian crows' brains can generate the mental firepower needed for tool use, Gray says.

He and his colleagues have shown that New Caledonian crows have larger brains for their body size than most bird species, including other corvids. In an unpublished study, the researchers find that regions of the brain that integrate information have expanded in the New Caledonian crows.

Brain evolution, and thus the emergence of a tool-using capacity, probably proceeded independently in corvids and nonhuman primates, Gray notes. ■

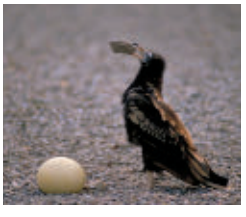
Back Story | TOOL USERS UNITE

Once thought to be a defining human trait, tool use has been observed in a range of species.

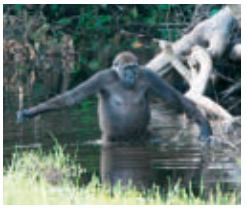


Chimps have been observed stacking boxes to stand on in order to grab otherwise unreachable bananas. The primates are also known to use twigs to get termites from a mound and to remove honey from bees' nests.

Bottle-nosed dolphins are sometimes seen sporting cone-shaped sea sponges on their beaks. The dolphins use the sponges to forage for food on the sandy ocean floor, flushing out small fish that dwell there.



Egyptian vultures can't break open ostrich eggs with pecking alone. Sometimes these birds will search 50-plus yards for the right rock to throw at an egg to crack it open. Apparently, though, the vultures' aim isn't so great; they often need a few tries to finish the job.



A wild gorilla has been observed using a walking stick to test water depths and aid passage across a pool in the Congo. Another used a piece of wood from a small shrub to stabilize herself during a different task.

Burrowing owls have been shown to use tools of a rather unpleasant kind. Researchers have reported that the owls collect the dung of several mammals and use it as bait to attract dung beetles, which the birds then eat.

CLOCKWISE FROM TOP RIGHT: C. BIRD, N. EMERY; GREG NEISE/LINCOLN PARK ZOO; EWA KRZYSZCZYK; OSF/A. CHRISTOF; THOMAS BREUER *ET AL.*; DARREN BENNETT

A floor lamp that spreads sunshine all over a room

The Balanced Spectrum® floor lamp brings many of the benefits of natural daylight indoors for glare-free lighting that's perfect for reading.

Ever since the first humans built a fire in their dark cave, people have realized the importance of proper indoor lighting. But ever since Edison invented the light bulb, lighting technology has, unfortunately, remained relatively prehistoric.

Modern light fixtures do little to overcome problems associated with improper lighting, such as eyestrain, dryness, and burning. As more and more of us spend longer and longer hours in front of our computer monitor, these problems are compounded. And the effects of improper indoor lighting are not necessarily limited to a physical problem: the quantity and quality of light can also play a part in both our mood and work performance.

Studies show that sunshine can both lift your mood and enhance your energy levels. But as we all know, the sun does not always shine. Now, however, there's a solution to the problem– The **Balanced Spectrum® floor lamp** will change not only the way you see, but also the way you feel about your living and work spaces. It brings the benefits of natural daylight indoors, simulating the full spectrum of daylight.

The **Balanced Spectrum's** 27-watt compact bulb is brighter than a 100-watt ordinary light bulb. With the lamp's sharp visibility, you will see with more clarity and enjoyment in close tasks such as reading, writing, sewing, and needlepoint. It is especially helpful for aging eyes.

Experience sunshine indoors at the touch of a switch. This amazing lamp is not only easy on the eyes, it is easy on the hands as well, featuring a special "soft-touch, flicker-free" rocker switch that is easier to use than traditional toggle or twist switches. And its flexible gooseneck design enables you to get light exactly where you need it. The high-tech electronics, the user-friendly design, and a bulb that lasts 10 times longer than an ordinary bulb–all these features make the **Balanced Spectrum® floor lamp** a must-have.

Try the Balanced Spectrum® floor lamp for the best value ever! Now more than ever is the time to spread sunshine all over the room in your home at this fantastic low price! The Balanced Spectrum® floor lamp comes with *first*STREET's exclusive guarantee. Try this lamp for 90 days and return it for the product purchase price if not completely satisfied.

You don't need the sun to get the natural benefits of daylight

- ***See with clarity and enjoyment***
- ***Creates natural, glare-free light***
- ***Provides sharp visibility***
- ***Flexible gooseneck design***
- ***Instant-on, flicker-free light***
- ***Pays for itself in energy savings over the life of the bulb***

This light can change the way you live and work

It provides excellent lighting which is very close to true daylight. The lamp itself is light enough to be moved easily around a room and an office. The glare-free characteristics provide a very non-stressful illumination for prolonged reading.
–Stanley G., M.D.

As soon as I turned on the lamp and began to read the newspaper I could see the wonderful difference. This lamp is just what I needed. Thank you so much.
–Donna E.

Your lamp has been a wonderful help to me in reading my newspaper and magazines. I would hate to be without this lamp, it's made such a difference in my life.
–Kenneth K.

Dozens of testimonials on file.
Results may vary.

Technology revolutionizes the light bulb

- ***Save almost $61 over the life of the bulb***
- ***8,000 hours bulb life***
- ***Energy efficient***
- ***Shows true colors***

Balanced Spectrum® floor lamp ..... was ~~$59.95~~

Call now for $10 instant savings!

Only $49.95 each + S&H

*Order two Balanced Spectrum® floor lamps and get **FREE shipping** on both lamps.

*Free shipping within the contiguous 48 states only.

Please mention promotional code 38491.

For fastest service, call toll-free 24 hours a day.

1-888-654-0586

We accept all major credit cards, or if you choose, you can pay by check over the phone. To order by mail, please call for details.

www.balancedspectrum.com

firstSTREET for Boomers and Beyond®

1998 Ruffin Mill Road
Colonial Heights, VA 23834

41477

Atom & Cosmos

For longer versions of these and other Atom & Cosmos stories, visit **www.sciencenews.org**

Green Peas produce a lot of stars

Compact galaxies could shed light on more distant systems

By Ron Cowen

For galaxies, it's not easy being green. Most appear blue or red from Earth.

Indeed, after combing through an online image bank of about 1 million galaxies, volunteers for the Galaxy Zoo project have found a mere 251 — dubbed the Green Peas — with an unusual, greenish color. Each of these compact bodies is only about one-tenth the size of the Milky Way.

Now, a team of astronomers working with the volunteers has discovered that the Green Peas are hamming it up, forming stars at an enormous rate — about 10 times faster than in the Milky Way. Spectra of the galaxies taken by the Sloan Digital Sky Survey indicate that the greenish hue comes from the glow of ionized oxygen gas heated by newborn stars, says Carolin Cardamone of Yale University.

High rates of star formation are common among some remote galaxies, which hail from the early universe, but the Green Peas are relatively nearby — between 1.5 billion and 5 billion light-years from Earth. Green Peas may represent a closer, easier to observe analog of those distant galaxies, Cardamone and colleagues report in an upcoming *Monthly Notices of the Royal Astronomical Society*.

These portraits show a handful of rare, newly discovered galaxies dubbed Green Peas that are forming stars as fast as some remote galaxies.

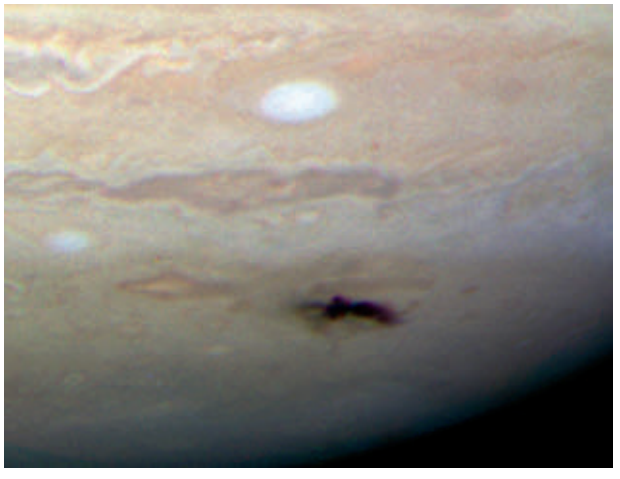
Galaxies from further back in time, when the universe was one-fourth to one-third its current age, forged many more stars than today's typical galaxies do, notes Alice Shapley of the University of California, Los Angeles. That's because the early galaxies were pulling in a fresh supply of gas, the raw material for making stars, at a much higher rate than galaxies do today.

Those few galaxies that exhibit high star-formation rates today are usually undergoing a rare, major merger with another galaxy. But the Green Peas appear to be loners, mostly devoid of mergers. "If the Green Peas are really isolated systems, then the origin of their high star-formation rates is a real mystery," Shapley says.

Shapley points to similarities and differences between the Green Peas and the remote population, known as Lyman-break galaxies. She agrees that the Green Peas appear to be distinct from typical, nearby star-forming galaxies and concurs that the Peas are forging stars at a prodigious rate similar to the Lyman-break galaxies. But these remote galaxies are considerably more massive and their abundance of elements heavier than helium seems higher on average compared with the Green Peas, she notes.

In a new study, Shapley and her colleagues have delineated several properties that contribute to the high star-formation rate in the remote Lyman-break galaxies. The team's findings, in the August 10 *Astrophysical Journal*, suggest that gas collapsing to form stars in these distant galaxies coalesces into slightly heavier stars on average than the gas in galaxies today does.

Shapley says she looks forward to seeing additional measurements made for the newly discovered galaxies.



Jupiter takes it on the chin

Jupiter has taken another hit. A new dark bruise in Jupiter's upper atmosphere reveals that an object has recently bashed the giant planet's south polar region. The discovery comes 15 years after fragments of Comet Shoemaker-Levy 9 hit the planet and created a memorable display of scars, waves and plumes. It's unclear whether the projectile was a comet or an asteroid, says Hal Weaver of the Johns Hopkins Applied Physics Laboratory in Laurel, Md., but the size of the scar in Jupiter's atmosphere suggests the body had a diameter of a few hundred meters, similar to that of some of Shoemaker-Levy 9's smaller fragments. Observations following the discovery suggest that the impact came from a single body, not a sequence of objects, as was the case with Shoemaker-Levy 9. — *Ron Cowen*

FROM TOP: C. CARDAMONE, SLOAN DIGITAL SKY SURVEY; H. HAMMEL/SPACE SCIENCE INSTITUTE, JUPITER COMET IMPACT TEAM, NASA, ESA

Genes & Cells

For longer versions of these and other Genes & Cells stories, visit **www.sciencenews.org**

A new recipe for brown fat

Energy-burning cells offer potential obesity treatment

By Laura Sanders

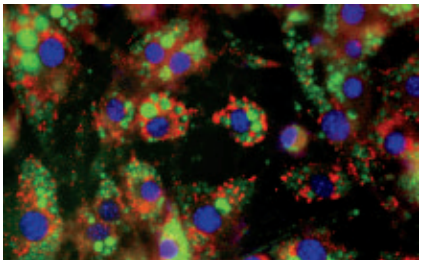
Researchers have whipped up a batch of calorie-burning brown fat cells, a feat that may ultimately lead to new treatments for obesity and diabetes.

"Brown adipose tissue is coming to the forefront of research in diabetes and obesity because its role is burning energy," says Francesco Celi of the National Institute of Diabetes and Digestive and Kidney Diseases in Bethesda, Md.

Known to keep babies warm, brown fat has recently been shown to be present and active in adults (*SN: 5/9/09, p. 10*). So it might be feasible to combat obesity by increasing the amount and activity of adult brown fat stores.

In the new study, researchers found that PRDM16, a protein important for producing brown fat cells from pre-muscle cells called myoblasts, requires a partner, C/EBP-beta. Either protein on its own had no effect on mouse myoblasts in a lab dish, reported Bruce Spiegelman of Harvard Medical School in Boston and colleagues. But when genetically engineered to produce more of both proteins, myoblasts divide into energy-burning brown fat cells (and copies of themselves), the researchers reported online July 29 in *Nature*. Further experiments showed that the method worked on fibroblast cells taken from mouse skin and from a human baby's foreskin.

These new brown fat cells had many of the same properties as bona fide brown fat cells, Spiegelman says. And when researchers transplanted some of the engineered fibroblast cells into live mice, the cells formed distinct pads at the injection site and were metabolically active.



Mouse cells were coaxed into producing brown fat cells (shown here). Green dots are oil droplets, red dots are mitochondria and blue spheres are cell nuclei.

One way to enhance brown fat stores for new treatments would be to remove cells from a person, engineer them to produce the two proteins and then return the cells to the body to create brown fat cells. Another approach, Spiegelman says, could be to find synthetic compounds that induce cells in the body to divide into brown fat cells.

Unlike natural brown fat cells, though, which can tune energy consumption to adapt to different conditions, these newly created fat cells appear to always be set on high. This may be a problem for therapeutic interventions, comments Leslie Kozak of Pennington Biomedical Research Center in Baton Rouge, La. What's more, the two proteins required for the switch to brown fat might have many other targets, and therefore unintended consequences, in the cell, Kozak says.

New nerve cells grow in mouse gut

Study suggests novel approach to fight intestinal disorders

By Jenny Lauren Lee

A new way to treat digestive disorders may be hidden in the bowels of mice. Researchers report in the Aug. 5 *Journal of Neuroscience* that new gut nerve cells are born in adult mice and that the process can be sped up. The find suggests that gastrointestinal disorders may one day be treated with drugs that could stimulate the generation of nerve cells.

Scientists no longer think that people are born with all the neurons they will ever have. Researchers have found, for example, that neurons involved in smelling and memory are produced in the brain into adulthood (*SN: 9/27/08, p. 5*).

Guts of adult mice contain stem cells with the potential to become neurons, but evidence for neurogenesis had been found only in cells in petri dishes and in very young mice. Baby neurons, if they formed in mature mice, apparently grew too rarely and too slowly to be detected.

"We knew new neurons had to develop in the gut," says developmental biologist Allan Goldstein of Massachusetts General Hospital in Boston, who was not involved in the study. "But to demonstrate how that process occurs and how it can be stimulated in vivo is novel and exciting."

Michael Gershon of Columbia University and colleagues flooded the guts of adult mice for a week with a molecular marker that labels newborn cells. Any new neurons born during that week would retain the marker. After waiting up to six months, the team found a small number of cells with the marker, suggesting that new neurons were created in the stomach and intestines of the mice.

Gershon's team also found that two molecules known to interact with the receptor for the neurotransmitter serotonin seemed to speed neurogenesis, opening the possibility of new drugs to alleviate chronic constipation and other disorders involving damage to neurons in the gut.

It's too early to assess therapeutic potential, but the work is "really interesting from a developmental perspective," says neurobiologist Jack Mosher of the University of Michigan in Ann Arbor.

SHINGO KAJIMURA

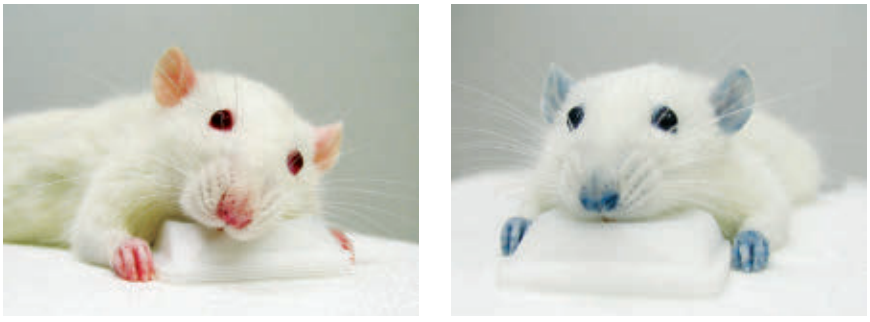
Body & Brain

For longer versions of these and other Body & Brain stories, visit **www.sciencenews.org**

Brilliant blue for the spinal cord

Rats that get dye after injury show motor improvements

By Rachel Ehrenberg



Rats that got brilliant blue dye after a spinal cord injury (right) improved more than untreated rats (left), a study shows. A blue tinge appeared to be the only side effect.

A blue dye found in Gatorade and rocket pops could play a protective role in the cellular mayhem that follows spinal cord injury. In rats, a relative of the dye appears to block a molecule that floods the injury site and kills nerve cells, a team reports in the July 28 *Proceedings of the National Academy of Sciences*.

Rats dosed with brilliant blue G — a chemical cousin of FD&C Blue No. 1 — after injury showed greater improvement in motor skills than other rats. And the low toxicity of FD&C Blue No. 1 suggests a new approach for treating spinal cord trauma in humans, injuries for which there are few therapies.

"It's not a cure," says neuroscientist Maiken Nedergaard of the University of Rochester Medical Center in New York, who led the new study. "I don't think that anything can cure this, but for the patient it could be a big improvement."

The results are impressive, comments Lynne Weaver of the Robarts Research Institute in London, Canada. Weaver notes that the side effects of any potential therapy must be considered, but "the principle is interesting."

ATP, short for adenosine triphosphate, is known as the energy currency of cells. But a few years ago Nedergaard and her colleagues reported that ATP wreaks havoc when the central nervous system is injured, flooding the injury site and hitting a receptor molecule that sits on various cells. ATP binds to this receptor, called P2X7, resulting in a cascade of events that leads to cell death.

Nedergaard and colleagues had already found that blocking P2X7 could temper the damage from spinal cord trauma, but the team wanted a nontoxic blocker.

Brilliant blue stepped up. Using a common setup that drops a heavy weight on a rat's lower back, the scientists inflicted spinal cord injuries on the animals. Fifteen minutes later, some rats received an IV containing the dye, and those rats got additional doses on days two and three after the injury. Initially, the severely injured rats couldn't walk. But over the course of six weeks, the rats treated with brilliant blue had improved locomotion and performed better on gait assessments than untreated rats, the team reports.

The research team is now exploring how effective the dye is when it is administered later. While clinical use of brilliant blue is years off and would require studies in humans, it looks promising, says Nedergaard. "It could be you drink blue Gatorade on the way to the hospital."

Overlooked organ gets new respect

Research reveals that the spleen harbors immune agents

By Nathan Seppa

It's high time somebody said something nice about the lowly spleen. The much-maligned organ serves as a holding tank for ready-to-go immune agents called monocytes, a new study finds. These cells are first responders to trouble sites, and the spleen is their main dispatcher, researchers report in the July 31 *Science*.

While it's true that people can survive without a spleen, the organ is far from worthless. It recycles iron from old red blood cells, houses fresh blood cells, synthesizes antibodies and acts as a chamber in which pathogens are killed.

In the new study, scientists add to this list of duties, showing that the spleen stores monocytes in compartments close to mainstream blood vessels. This allows monocytes to travel to trauma and infection sites on short notice to take apart dead cells, clean up debris and foster tissue rebuilding, says study coauthor Mikael Pittet of Harvard Medical School in Boston. "Timing is a really important issue when you want to fight pathogens or heal after an injury," he says.

Pittet teamed with Harvard colleagues Filip Swirski, Matthias Nahrendorf and others to ascertain these monocytes' origins. In a series of experiments in which they induced heart attacks in mice, the researchers showed that many monocytes arriving at traumatized heart tissue could be traced back to the spleen.

Spleen removal can cause a diminished response to some vaccines and increased susceptibility to infections, note Ting Jia and Eric Pamer of the Sloan-Kettering Institute in New York City, writing in the same issue of *Science*. With the new finding, they argue, "the organ gains some new respect."

TAKAHIRO TAKANO

24,900 Projected number of new cases of throat cancer in the United States for 2009

5,890 Projected number of deaths from throat cancer in the United States for 2009

Fallout from September 11 lingers in the form of stress, asthma risk

Survey suggests serious health ramifications continue

By Nathan Seppa

As many as 25,500 people have developed asthma after exposure to dust from the fall of the World Trade Center towers following the terrorist attack on September 11, 2001, a new report suggests.

Even more people, some 61,000, have experienced post-trauma stress and related mental health problems after witnessing the collapse of the twin towers, researchers estimate in the study, published in the Aug. 5 *Journal of the American Medical Association*.

"This confirms what we are seeing," says Jacqueline Moline, a physician at Mount Sinai School of Medicine in New York City who runs a medical monitoring and treatment program for people affected by the tragedy. "The emotional side of this is not letting up."

JIM WATSON/U.S. NAVY

Witnessing the destruction or inhaling the dust at the 9/11 disaster scene is proving to have long-term health effects.

About 409,000 people were in the vicinity when the towers came down. Using telephone, e-mail, mail and in-person interviews, researchers created a health registry by surveying more than 68,000 of them in 2003 and 2004 and contacting some 46,000 in a second survey in 2006 and 2007. Participants were all adults and included office workers, residents, passersby and rescue workers.

The data show that more than 10 percent of exposed people who did not have asthma before the attack developed the breathing disorder during the six years afterward. Normally less than 3 percent of the adult population would be expected to develop asthma over a six-year period, says coauthor Lorna Thorpe, deputy commissioner of the New York City Department of Health and Mental Hygiene.

While the number of new asthma cases among people in this registry declined between surveys, the percentage reporting post-trauma stress symptoms in the second survey was higher than in the first, says study coauthor Robert Brackbill of the Centers for Disease Control and Prevention in Atlanta. Among those near the towers on September 11 who reported no traumatic stress before the attacks, 14 percent reported symptoms in the first survey and 19 percent in the second.

By extrapolating these data to apply to the 409,000 people in the towers' vicinity, the authors estimate conservatively that 25,500 people may have developed new asthma and 61,000 may have experienced post-trauma stress since the disaster.

The registry participants provide scientists with a group that may help to reveal the physical and mental health effects of huge disasters, Moline says. "And that can allow us to learn how best to treat people when another disaster occurs, whether man-made or natural."

NEWS BRIEFS

Allergy meds slim down mice

Over-the-counter allergy medications turn obese, diabetic mice into healthy, normal-weight mice, Harvard University's Guo-Ping Shi and colleagues report. After two months, mice on a high-fat diet receiving daily injections of one of two common over-the-counter allergy medications lost about 12 percent of body weight on average. These mice also had lower blood sugar levels. Mice not on the medication continued to gain weight and had relatively high blood sugar levels. The study appears online July 26 in *Nature Medicine* with three other independent studies that show a connection between type 2 diabetes and the immune system. —*Jenny Lauren Lee*

Treatable throat cancer

Cancer of the throat that stems from a human papillomavirus infection responds to treatment better than throat cancer related to smoking, alcohol or other causes, researchers report online July 29 in *Cancer Prevention Research*. Looking at five-plus years of survival data, Kevin Cullen of the University of Maryland Medical Center in Baltimore and colleagues found that HPV-negative throat cancer patients had a median survival of only 20 months. In contrast, patients with HPV-positive throat cancer lived substantially longer. Their median survival time could not be accurately discerned because many were still alive when the data were analyzed. The scientists also find that blacks are less likely than whites to have throat cancer attributable to HPV, which may explain why the cancer also proved more deadly in blacks overall in this study. —*Nathan Seppa*

Life

For longer versions of these and other Life stories, visit **www.sciencenews.org**

Death-grip fungus made me do it

Parasite benefits when host ants bite low-hanging leaves

By Susan Milius

The line between fungus biology and late-night television just got blurrier.

A fungus that attacks living ants apparently manipulates their behavior for its own benefit, a team reports in the September *American Naturalist*.

When the *Ophiocordyceps unilateralis* fungus strikes, an infected ant climbs to a leaf not far off the ground, bites in and dies with jaws locked in place. Experiments now show that these low-hanging leaves give the fungus prime conditions for growing a spore-bearing spike out of the ant's neck, says study coauthor David Hughes of Harvard University.

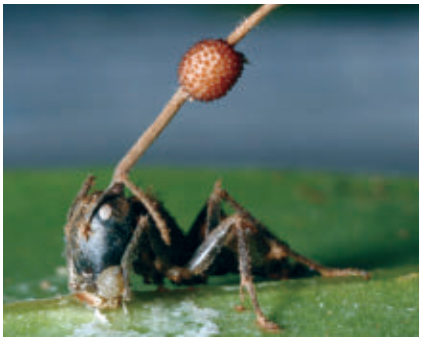
"For me, it is convincing evidence of manipulation," says parasitism researcher Frédéric Thomas of France's CNRS research station in Montpellier.

As far back as the 1920s, biologists had proposed that *Ophiocordyceps* infections turned ants into tree biters that latched onto leaves, twigs or the bark depending on which fungal species attacked. The possibility of fungal influence on the sick ant "was just crying out to be looked at," Hughes says.

Hughes and an international team studied *O. unilateralis*' effects on ants in a Thai forest. The researchers found natural graveyards of dead ants belonging to the species thought to be the fungus's main host. The ants were clamped onto leaves not far above the ground, typically just some 25 centimeters up. This first meter above the forest floor has more fungus-friendly humidity than the zones of the tree five meters and higher, the team reports.

Selecting dead ants at an early stage of infection, the researchers moved some of the carcasses onto the forest floor and moved others high into the canopy.

The fungus in ants that were relocated to the leaf litter didn't fare well, and the ants soon disappeared. Foragers may have eaten them, or rain swept them away. The high canopy didn't suit the fungus either. Inspections of ant corpses that were moved up there revealed deformed fungal growth that didn't produce spores.



This ant latched on to a leaf before dying from a fungal infection (parasite shown sprouting from the dead ant's neck).

Leaves near the tree base proved just right, though. A fibrous fungal spike grew out of the necks of ants there and bore a segmented, red-orange lump.

Forming that lumpy body allows the fungus to reproduce — a clear benefit, says Shelley Adamo of Dalhousie University in Halifax, Canada. But she adds, "The much harder question is whether the fungus is 'manipulating' its host."

The suggestion seems reasonable in this case, she says, but she notes that a colony-dweller might leave the nest when dying from a potentially contagious infection without necessarily falling under the direct control of the parasite.

Tiny bird, tiny genome

Flying with excess baggage is a drag, but hummingbirds have mastered efficient packing. The tiny hoverers (black-chinned hummingbird shown) have less DNA in their cells than any other previously studied birds, reptiles or mammals, researchers report online August 5 in *Proceedings of the Royal Society B*. Ryan Gregory of the University of Guelph in Canada and colleagues estimated genome size in 37 species of hummingbirds. Since two copies of the genome, or full book of genetic instructions, are typically present in each cell, lugging around a smaller genome means smaller cells, the thinking goes. Smaller cells mean a larger surface-to-volume ratio and more efficient gas exchange. Hummingbird genomes averaged a mere 1.03 picograms, or 1.03 trillionths of a gram, the team reports. The average for previously examined birds is 1.42 picograms, and for humans it is 3.5 picograms. Some salamander genomes weigh more than 100 picograms. —*Rachel Ehrenberg*

FROM TOP: D. HUGHES; LUIS MAZARIEGOS

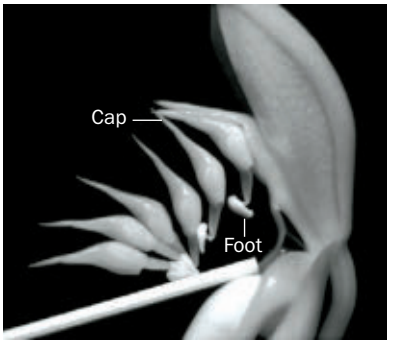
Plants & Fungi

For longer versions of these meeting stories, visit **www.sciencenews.org**

Bent tissue strip gives orchid kick

Study dissects how plants hit bees with pollen masses

By Susan Milius



A male *Catasetum* flower (left, top) hurls pollen. The composite image (top) shows steps in the send-off.

Like some people, *Catasetum* orchids get rough because they're bent out of shape.

Male flowers in this tropical genus don't wait for a visiting bee to nuzzle the pollen, explains Daniel Fulop of Harvard University. When a bee lands, brushing the flower's long trigger hairs, a floral structure slams a pollen mass onto the bee's back.

After studying 16 species in the genus, Fulop and Harvard colleague Jacques Dumais have now figured out how the pollen smacker works. Its power comes from the sudden release of a bent strip of tissue, called a stipe, attached to the pollen mass, Fulop reported July 27.

"It was just wonderful to see this mechanically complex problem dissected and explained," said Wendy Silk of the University of California, Davis.

A *Catasetum* flower uses scents to attract male bees. Near the male flower's pocket of volatile perfumes sits a long, multipart structure holding two pollen balls. At one end of the structure lies a sticky foot and the stipe, which curves over a bump in the middle of the flower and connects to the two balls and to the cap at the other end.

When a bee brushes against a pair of long trigger hairs, the pollen structure starts ripping loose from the flower at the end with the foot, Fulop reported. The stipe abruptly unbends and, along with the pollen balls, swings out and away.

The structure would somersault beyond the bee, though, if it weren't for a refinement. The end with the cap, the last part to break loose, gets pushed against a floral spur. The spur gives a bit and then springs back, batting the departing structure toward the bee. The sticky foot on the structure fastens the pollen balls in place.

What puts the zing into the action is the stipe, Fulop said. When it tears loose and straightens, it powers the pollen shot.

FROM LEFT: GUSTAVO ROMERO/HARVARD UNIV., CULTIVATED BY D. FULOP; J. DUMAIS, D. FULOP

MEETING NOTES

Nod-for-me potion

A notorious invader called the tree of heaven may have an unusual way of outsourcing some of its nutrient-finding efforts. The *Ailanthus altissima* trees, like most plants, can't process nitrogen from the air into a usable form. But clovers and many other legumes can with the help of bacteria housed in root nodules. The bacteria snag nitrogen from the air and convert it. Research now shows that trees of heaven exude a substance that revs up the roots of clover plants to form these nodules, Jesse Lincoln of Grand Valley State University in Allendale, Mich., reported July 27. Clover nodules eventually enrich the soil with more user-friendly nitrogen. This trick for enhancing local nitrogen may explain in part how trees of heaven thrive in pitiful soils, suggested collaborator Gary Greer, also of Grand Valley. —*Susan Milius*

Phragmites egg each other on

Patches of common reed may explode into world-domination mode with a little help from friends. An imported form of *Phragmites australis* can sit around without doing much harm but then suddenly spread relentlessly, choking out the daintier native form of the same species and other wetland plants. New work suggests that the invader spreads more quickly when genetically diverse neighbors of the same species move in, Karin Kettenring of Utah State University in Logan reported July 27. In test patches, reed flowers fertilized with a mix of pollen from three genetically different reeds yielded 10 times as many viable seeds as did self-fertilized plants. —*Susan Milius*

Bat fungus in Europe

A fungus linked to bat die-offs has now been found in Europe, according to an update. In what's known as white-nose syndrome, the fungus forms patches on the noses and other exposed skin of hibernating bats. The bats emerge too early in the season and die emaciated, as if from starvation. Mycologist Andrea Gargas of Symbiology, an independent research organization in Middleton, Wis., and colleagues named the fungus *Geomyces destructans* and described it in the April–June *Mycotaxon*. White-nose syndrome first came to scientific notice in New York. Now the fungus ranges from Canada south to Virginia, Gargas reported July 28. Genetic evidence also indicates that the fungus is in Europe, though there haven't been reports of widespread die-offs there, Gargas said. —*Susan Milius*

Earth

For longer versions of these and other Earth stories, visit **www.sciencenews.org**

Churning water by the numbers

Small swimmers may affect ocean mixing and climate

By Rachel Ehrenberg

***Mastigias* jellyfish (shown) and other small swimmers drag water with them as they move. Their role in ocean mixing may be bigger than thought, scientists report.**

Small ocean dwellers like krill don't idly go with the flow. In fact, the water flows with their go, new research has found, suggesting that tiny swimmers may have a big impact on ocean mixing.

Energy from small animals is a major component of the total contributed to the ocean by all swimming creatures, which is comparable to that of winds and tides, scientists report in the July 30 *Nature*. Scientists modeling global climate processes may need to add the contribution of such swimmers to the mix.

The analysis "doesn't leave a lot to doubt — it's very convincing," says oceanographer William Dewar of Florida State University in Tallahassee.

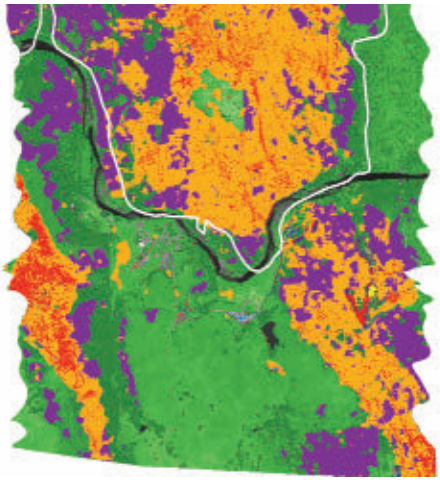
Scientists had thought that tiny, shrimplike copepods, or even animals such as fist-sized jellyfish, had little influence on ocean mixing. Turbulence created by small creatures would quickly dissipate, quashed by the viscosity of the water, which is thick like honey at the copepod scale. But fieldwork, theoretical modeling and energy calculations reveal that generating a wake isn't the only way to stir the waters. Swimmers also drag fluid along as they move, an effect that is enhanced in the viscous setting of the small scale, the new research showed.

Charles Darwin's grandson, physicist Charles Galton Darwin, first described in the 1950s how fluid travels along with a solid body in motion. It's similar to "drafting" in a bicycle race, says John Dabiri of Caltech, who led the new study. The lead cyclist carries along a flow of air, creating a sweet spot of low pressure for the cyclist riding close behind.

When even a small swimmer moves through water of different temperatures — as krill do nightly, migrating from deeper waters to the surface — cold water that goes along mixes with warmer water higher up. Tiny creatures carry more water with them per their bodies' volume than large creatures do, because more of the relatively "thick" water flows along.

In the South Pacific, Dabiri's team investigated the fluid dynamics of mixing by the local jellyfish *Mastigias*. Squirting a fluorescent dye in front of the swimming jellyfish allowed the scientists to track the flow of water moving with the jellies.

Calculations suggest that the ocean power input from all sea creatures may be as much as a trillion watts, Dabiri says. Even small movements may influence the cycling of heat and carbon in the oceans, important factors for global climate.



Spotting danger from on high

Airborne instruments can scan the ground to quickly detect rocks and soil that may contain naturally occurring asbestos, researchers report in the August *Geology*. In many regions, rock outcrops can host several types of fibrous minerals known as asbestos. Known for being a hazard in buildings, asbestos can also be a health concern for people who live on land that contains the minerals. Gregg Swayze of the U.S. Geological Survey in Denver and his colleagues took advantage of the fact that minerals in the asbestos family — and the minerals from which they're derived — tend to absorb much of the 2.3-micrometer–wavelength light that falls on them. Viewed in light near that wavelength, such minerals appear darker than others. Using airborne sensors tuned to specific wavelengths, the researchers scanned areas of California known to harbor asbestos. Data suggest that the instruments can successfully spot rocks that may contain asbestos (in red and orange in this image showing parts of El Dorado and Amador counties) even when the areas are 80 percent covered by dry grass. — *Sid Perkins*

FROM TOP: K. KATIJA, J.DABIRI; USGS

Environment

For more Environment stories, visit **www.sciencenews.org**

Team identifies new path to haze

Reactions turn hydrocarbon into light-scattering aerosols

By Sid Perkins

Scientists now know how a natural hydrocarbon emitted in large quantities by plants can be transformed into light-scattering aerosols that contribute to haze and influence climate. The finding will improve models of atmospheric chemistry and climate and may help explain puzzling field observations in some parts of the world, the researchers report.

Worldwide, plants release more than 550 million metric tons of the hydrocarbon isoprene into the atmosphere each year. But scientists have disagreed about the particular chain of chemical reactions that transform isoprene into haze-forming aerosols, says Fabien Paulot of the California Institute of Technology in Pasadena. Now, lab tests by Paulot and colleagues, reported in the Aug. 7 *Science*, have identified a class of substances long suspected to form as an intermediate in those reactions but never before seen.

The team created the chemicals, called dihydroxyepoxides, by placing isoprene and hydrogen peroxide in an 800-liter bag of unpolluted air and then illuminating the mix with ultraviolet light. The UV light stimulated chemical reactions, just as sunlight would, and the hydrogen peroxide served as a source of hydroxyl radicals — highly reactive compounds known as "the detergent of the atmosphere," Paulot says. Isoprene and hydroxyl radicals reacted to form dihydroxyepoxides via two separate chemical processes. The resulting epoxides readily dissolve into droplets of moisture in the air to form organic-rich aerosols, Paulot says.

This process could be a major source of atmospheric aerosols produced by living things. Other aerosol sources include volcanoes, fossil fuel burning and sea spray.

"This is a wonderful piece of work," says Neil Donahue, an atmospheric chemist at Carnegie Mellon University in Pittsburgh. Besides helping scientists better understand hydroxyl concentrations in the atmosphere, the findings may explain the high levels found in the tropics. Aerosols affect how much sunlight reaches Earth's surface and how much is scattered back into space, so including the process may refine climate simulations.

Numbers

For more Numbers stories, visit **www.sciencenews.org**

Analysis of TV viewer habits sorts commercial bargains from lemons

Highest-rated shows may not always be best for advertisers

By Laura Sanders

Advertisers who shell out big bucks for a commercial during a popular TV show might be buying a lemon, a new study finds. In the future, detailed data collected from digital cable boxes may help advertisers bargain-hunt for the best deals, a researcher suggested August 3.

Prices for commercial spots are primarily determined by the size of the audience that watches a particular show. Ads that run during blockbusters like *Grey's Anatomy* and *American Idol* are much pricier than ads during less popular shows. But audience size may not be the best way to judge commercial viewership, said study author David Schweidel of the University of Wisconsin–Madison.

Schweidel analyzed viewing habits in a large West Coast metropolitan area. Cable box data collected each second in prime time uncovered what shows (and commercials) people watched on five networks, and how choices changed when the programming went to a commercial.

Conventional wisdom says that 5 to 10 percent of the audience switches channels during commercial breaks, Schweidel said. "On average, that's true," he said. But the new analysis turned up cases where the audience level dropped by more than 20 percent. "That's a big difference in exposure for your ad," he said.

For most shows, commercial audiences were lower than show audiences, and some shows fared worse than others. The cooking reality television show *Hell's Kitchen*, for instance, drew 2.96 percent of the monitored cable box traffic, but its commercial audience was 2.42 percent, an 18 percent drop. Relatively high audience retention came from the drama *NUMB3RS*, which drew 1.90 percent of traffic and held on to 1.78 percent during the commercials. Because of these different drop-off rates, using audience size alone to predict how many people view a commercial "doesn't make a whole lot of sense," Schweidel said.

Commercial audience size varied across genre, across networks and even depended on time of day, the study found. But some generalizations could be made: People were less likely to avoid a commercial late at night. The length of the commercial break and whether other commercials were simultaneously on other channels also affected how many people stayed tuned. And overall, dramas did better at holding audiences through commercial breaks than did reality television shows, the analysis showed.

"Ultimately, if one had this data across all parts of the country, it would give us a deeper understanding of viewer behavior across the day," says Mike Bloxham of the Center for Media Design at Ball State University in Muncie, Ind.

One limitation to the analysis is that tuning data alone doesn't necessarily mean a person was actually watching the commercial, Schweidel said. ■

Giving baseball better numbers

Statisticians offer improved way to measure fielding skill

By Laura Sanders

Astute baseball fans know which players possess the golden glove, but assigning a number to defensive skill has been tricky. New statistical methods could offer a more accurate assessment than traditional methods, Benjamin Baumer reported August 5.

Officially, fielding ability has been calculated by dividing a player's number of errors by the total number of chances the player had to make a play, and subtracting that number from one. But this formula doesn't credit a fielder with range, who can successfully run down a ball that would be out of reach for other players.

Two proposed methods get around this problem, said Baumer, a statistician for the New York Mets and a doctoral student at the City University of New York. The first, called a discrete model, divides the field into zones and divides hits into categories based on type, direction, handedness of pitcher and other features. The probability of an average player fielding a particular kind of ball in a zone is compared with how a player actually played. Many variations of this method exist, some with tweaks that account for variables such as ball hogging.

A second method, proposed by Shane Jensen of the University of Pennsylvania in Philadelphia in June in the *Annals of Applied Statistics,* does not divide the field into zones. Instead, it mathematically describes a smooth, continuous playing surface.

The reliability of the different methods was assessed using data for real players from year to year, based on the assumption that the player would play consistently (meaning the scores should not vary drastically). The methods work, but could still be improved, Baumer found.

For a sample of 4,000 balls in play in Major League games, a discrete method was more reliable when it accounted for ball hogging. The continuous method performed well for players in the outfield, but didn't perform well in the infield.

Statistical methods should be part of evaluating a player's skill, says Matthew Johnson of Columbia University. "It's definitely true that seeing something with your own eyes is worth something, but it's also naïve to ignore the numbers." ■

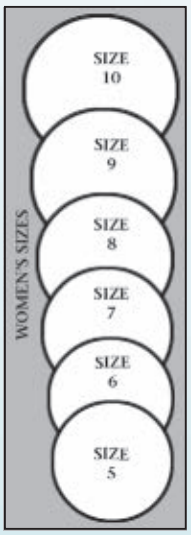
"An exquisite 1 carat black diamond for under $200—*unbelievable!*"
— James T. Fent, *Stauer GIA Graduate Gemologist*

Less than 680 still available. A genuine one carat diamond ring at an incredible price—under $200!

Black is the New Black

Experience some of that old black magic at an unbelievable price: a genuine 1-carat Black Diamond Ring now under $200!

When I strolled into the palatial lobby of the Grand Casino in Monte-Carlo, I headed straight for the roulette table to place my one bet for the evening. Of course, I bet it all on black. Black diamonds that is. I met our Belgian diamond dealer in the casino here and he pulled out a black suede pouch. He had almost 900 carats of rose cut black diamonds with him. When he told me the terrific price, I said that I'll take them all. Faceted one carat diamonds for under $200 a carat—maybe this is one time you can leave a casino with a winning hand.

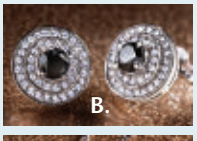


USING THE RING SIZE CHART
Place one of her rings on top of one of the circle diagrams. Her ring size is the circle that matches the inside diameter of the ring diagram. If her ring falls between sizes, order the next larger size.

Right now, black diamonds are the hottest precious stones in high-end jewelry. You see them everywhere, from the glitz and glamour of the French Riviera to the haute-couture fashion houses of London, Paris and Milan. And thanks to our priceless connections with the Belgium's top gem cutters, Stauer has found a way to make black diamonds even more attractive.

Introducing the Exclusive Stauer Rose Cut. Our ***Black Diamond Ring*** is a true stunner in classic black and white. But what really sets it apart from other black diamond jewelry is the exclusive Stauer Rose Cut. You'll see that we meticulously engineered the geometry to coax the best sparkle from the bold black stone. Every angle and edge catches and bounces back the light, setting the center stone on fire.

The ***Black Diamond Ring*** features a 1-carat, rose-cut genuine black diamond surrounded by 48 brilliant, lab-created white DiamondAura®. The gem-quality black diamond is prong-set in the finest .925 sterling silver and rises up from the concentric circles, like pond ripples that sparkle with dozens of fiery facets. The shoulders are adorned with their own glittering epaulets, radiant rows of DiamondAura® that draw the eye back to the diamond center.



Our buying power saves you thousands. You can find similarly designed black diamond rings that are selling for $2,000, $3,000 and even $4,000 per carat! How is it possible that Stauer can offer our spectacular ***Black Diamond Ring*** for less than $200? It's simple, really. Since we buy literally millions of carats of precious gemstones every year, no one can touch our price.

Try our Black Diamond Ring. And, if for any reason, you find yourself looking like less than a million bucks, just return the ***Black Diamond Ring*** within 30 days for a refund of your purchase price. But, be warned. Once you've had a taste of the "good life", there's no turning back.

JEWELRY SPECS:
- 1 ctw genuine black diamond
- 48 scientifically-grown Diamond*Aura*®
- .925 sterling silver setting - Ring sizes 5–10

A. **Black Diamond Ring** (1 ¾ ctw)
~~$295.00~~ **$195.00**
B. **Black Diamond Earrings** (1 5/8 ctw)
~~$495.00~~ **$295.00**
C. **Black Diamond Pendant** (1 5/8 ctw)
~~$295.00~~ **$195.00**
Black Diamond Set—~~$1,085.00~~ **$645.00**
Save $440

Call now to take advantage of this limited offer.

1-888-201-7659

Promotional Code BDR134-01
Please mention this code when you call.

Stauer
14101 Southcross Drive W.,
Dept. BDR134-01
Burnsville, Minnesota 55337
www.stauer.com

Smart Luxuries—Surprising Prices

Pearls Unstrung

For a while, the Great Lakes weren't connected by rivers and Niagara Falls was just a trickle

By Sid Perkins • Illustration by Charles Floyd

The thundering roar at the base of Niagara Falls is awesome indeed. On an average summer day, about 40 million gallons of water spill over the half-mile–wide Canadian portion of the cataract each minute. After falling over a cliff taller than a 16-story building, water pummels the rocks below, incessantly eroding the base of the cliff and triggering rockfalls. Before the 20th century, when engineers weakened the Niagara River by diverting some of its flow to produce hydroelectric power, the falls marched upstream an average of more than a meter per year.

Niagara Falls is one of the last links in an impressive chain: Water flows from Lake Superior and Lake Michigan to Lake Huron, onward to Lake Erie, then down the Niagara River and over the falls to Lake Ontario and thence to the sea. Today the falls seem unstoppable, but scientists have learned that there was a time after the most recent ice age when Niagara Falls was a mere trickle and the Great Lakes were a little less great.

During the ice age, which began about 100,000 years ago, a kilometers-thick ice sheet smothered the region. And Niagara Falls — or the ice-covered cliff that would become the falls — was located several kilometers downstream of its current site. Sometime around 13,000 years ago, the ice retreated northward, leaving meltwater to accumulate in gouges that were left behind.

With the first flush of meltwater, lake levels rose and the falls raged. Studies show that as ice retreated and climate

dried, however, the falls slowed to a trickle for several millennia, starting about 10,000 years ago. Scientists once thought that the falls slowed because the overflow from Lake Erie was rerouted to a different spillway when the landscape tilted and shifted as it was relieved of its icy burden. But now they are learning that some of the rivers connecting one lake to another simply disappeared during a long dry spell that started about 12,500 years ago.

In the last decade or so, scientists have uncovered clues that the water level in Lake Erie — and indeed, the levels in at least some of the other Great Lakes — fell well below all natural outlets, rendering those lakes isolated bodies of water.

New studies, including archaeological surveys and genetic analyses of fish, bolster the notion that today's submarine ridges and nearshore shallows were once land bridges and lakeside beaches.

SATELLITE MAP: NASA

A natural wonder-to-be

An artist's illustration, above, shows what Niagara Falls may have looked like more than 8,000 years ago when it was smaller and located several kilometers downstream. At the time, Lake Erie was an isolated body of water, so the Niagara River — which today spills over the falls on its way north to Lake Ontario — was fed only by local streams and carried no more than 10 percent of today's flow. The falls' erosive march upstream (see map, left) resumed about 6,300 years ago, when changes in the post-ice age landscape rerouted the spillover from Lake Huron to Lake Erie and the river regained full flow.

Ups and downs

Today, even small fluctuations in lake levels can have a big effect on the region. In a good year, vessels from the United States, Canada and other nations transport more than 200 million tons of iron ore, coal and other cargo on the lakes, says Glen Nekvasil, vice president of the Lake Carriers' Association, based in Rocky River, Ohio. For every inch (2.5 centimeters) that lake levels drop, he says, the 65 vessels represented by the trade group must forgo carrying about 8,200 tons of cargo.

Instruments have tracked Lake Erie's water level only since the mid-1800s, but in that time the level has, according to modern standards, fluctuated substantially. From 1900 to today, the lake's surface altitude has varied by about 1.5 meters, says Gregory C. Wiles, a paleoclimatologist at the College of Wooster in Ohio. Although many people have suspected that human activity — dredging, engineering projects and the like — caused those variations, a study reported by Wiles and his colleagues in the March 6 *Geophysical Research Let-*

ters hints that natural climate cycles are largely to blame.

Today, average precipitation over Lake Erie is about 99 centimeters per year, the researchers note. But evaporation steals about 90 centimeters of that water annually; the surplus water joins the incoming flow from the upper Great Lakes and exits Lake Erie via the Niagara River, says Wiles. Water level in the lake depends on the balance between income and outgo: In spring, when snowmelt is prodigious and temperatures — and therefore evaporation — are relatively low, the lake's level is typically at its high point for the year. In late summer and autumn, when air temperatures and evaporation are relatively high, the level sinks.

Similarly, extended dry spells across the Upper Midwest cause lake levels to fall, says Wiles. The lowest recorded water level in Lake Erie came during the mid-1930s, near the end of the driest stretch of the Dust Bowl years. High lake levels from the 1970s through the 1990s may have resulted from weather patterns that brought higher-than-normal amounts of moisture north from the Gulf of Mexico.

Data locked in tree rings offer a way to extend the precipitation record of the Midwest back in time. For example, tree ring data from forests along the Gulf of Alaska indicate that when winter sea-surface temperatures in the North Pacific were warmer than normal, the Upper Midwest received less precipitation. That, in turn, caused water levels in the Great Lakes to drop. This link alone can explain half the modern variations in Lake Erie's level, Wiles and his colleagues report.

Other climate cycles — including El Niño, the warming of sea-surface temperatures in the eastern and central Pacific — influence rainfall in the Great Lakes basin as well, the researchers' analyses concluded.

"The Great Lakes are a great dipstick of the region's climate," says Wiles.

And climate will help determine the lakes' future as well. A recent report from the U.S. Global Change Research Program states that, under a business-as-usual scenario for carbon dioxide emissions, Great Lakes levels will drop substantially toward the end of this century. Between 2020 and 2100, the water level in Lake Superior will decline about 15 centimeters, the researchers estimate. Over the same time period, water levels in Lake Huron and Lake Michigan will decline almost 50 centimeters, a change that could render parts of some harbors largely inaccessible.

Wide swings

Compared with today, water levels in the Great Lakes seesawed wildly after the last ice age, including occasional big rises. And evidence also suggests that some lakes were overflowing while others were evaporating away.

In 2008, scientists reported that small spruce saplings buried high in an embankment along the northwestern shore of Lake Superior indicate that the lake's surface rose at least several meters — drowning the region for several centuries beginning about 8,900 years ago — before levels sank again (*SN Online: 10/9/08*).

But most known excursions in Great Lakes water levels, including those in the eastern lakes at the same time, have taken lake surfaces lower than modern averages, says Mike Lewis, a marine geologist emeritus with the Geological Survey of Canada in Dartmouth. Sonar scans of Lake Superior's floor show kilometers-long troughs that were scoured by icebergs at the end of the last ice age (*SN: 1/6/07, p. 14*). Those features, as well as long-submerged beaches revealed by other sonar studies, reveal that water levels in the lake fell at least 70 meters below the modern-day average some time in the past 10,000 years or so, Lewis notes. What are now nearshore shallows would have been exposed during that era and could have been home to villages and broad hunting grounds for Native Americans.

Sonar scans taken off the northeastern shore of Lake Erie also show relict, now-flooded beaches. And analyses of sediments extracted from one of those ancient shorelines, as well as cores drilled elsewhere in the lake, reveal new details of the lakes' configuration after the last ice age, Lewis and his colleagues reported in Toronto in May at a meeting of the American Geophysical Union. Not only were the Great Lakes' levels at the end of the last ice age lower than they are today, the researchers note, but also the lakes covered much less area.

The relatively shallow western regions of Lake Erie, for example, were covered by marsh plants between 14,600 and 12,900 years ago — a sure sign that this area was mostly exposed as the last ice age drew to a close and that lake levels during this interval were far lower than they are today. Sediment cores drilled from the center of the lake reveal that the accumulation of mud there decreased substantially between 12,500 and 8,300 years ago. Finally, Lewis notes, a sediment core drilled from a now-flooded beach about 30 meters below the lake's surface indicates that mud began to pile up on that wave-eroded surface only after 8,400 years ago.

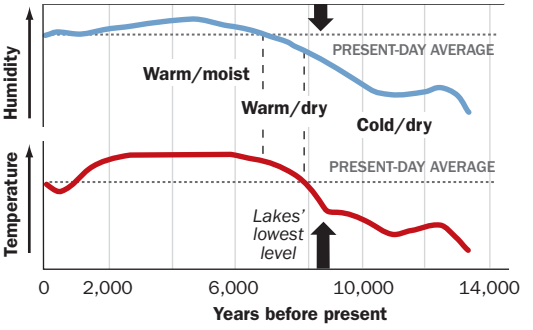
Specifically, water levels in Lake Erie were falling at the same time that overflow from Lake Huron, the nearest neighbor upstream, flowed to the sea via other routes. Today, between 85 and 90 percent of the water that flows out of Lake Erie has flowed in from the Great Lakes upstream. Dry up that source of water, Lewis says, and evaporation quickly begins to outpace the lake's accumulation of precipitation.

About 7,600 years ago, lake sediments also began to include hemlock pollen — a sign, says Lewis, that climate became wetter and stayed that way. Accordingly, lake levels gradually rose about seven meters in the centuries that followed. Finally, about 6,300 years ago, the overflow from Lake Huron again switched southward and spilled into Lake Erie, filling it to the brim and once again cranking up the faucets at Niagara Falls.

Life in the old Great Lakes

Not all the evidence regarding water levels in the Great Lakes has come from rocks and sediments. Archaeological and genetic evidence left behind in and around the lakes supports the idea that

Climate exchange
A reconstruction of the ancient climate (temperature shown in red, humidity in blue) of the Great Lakes region



Great Lakes then and now

During an extended dry spell that began about 12,500 years ago, the easternmost Great Lakes (Huron, Erie and Ontario) were isolated bodies of water. Modern-day lakes are shown in dark blue, and lakes at their lowest past levels—when Lake Huron was divided by a land bridge and Lake Erie was nearly split as well—are depicted in light blue. Data for Michigan and Superior are not available. In the graph at right, scientists have used a variety of climate indicators, including pollen and isotopic analyses of sediments, to reconstruct trends in temperature and humidity for the Great Lakes region for the past 13,500 years. The terms warm, cold, moist and dry are defined relative to modern-day values (dashed horizontal lines). Arrows show approximately when the eastern lakes reached their lowest level, about 8,800 years ago. At this time, the Niagara River and Niagara Falls were much smaller.

their surfaces were once dramatically lower than they are today. This landscape would have been vastly different for animals and early people of the Great Lakes.

Earlier this summer, researchers reported that sonar and video surveys of a submarine ridge in Lake Huron revealed structures similar to those used to guide caribou by modern-day hunters in the high Arctic (*SN: 7/4/09, p. 14*). Between 8,300 and 11,300 years ago, the now-flooded ridge would have been a 16-kilometer–wide land bridge connecting the state of Michigan and Ontario, Canada. The find hints that other structures, possibly even the remnants of small villages, may be preserved on what was once prime lakeside real estate.

The legacy of the disconnected lakes is seen in today's fish populations as well. Despite an apparent lack of geographical barriers between those five lakes today, fish that inhabit Lake Erie have minor mutations in their genetic code that make them genetically distinct from their kin in the other lakes.

Take, for instance, the smallmouth bass, *Micropterus dolomieu*. After the ice sheet covering the Great Lakes retreated, bass that lived in unfrozen rivers and other refuges — including the Mississippi, St. Lawrence, Ohio and Hudson rivers — recolonized the lakes, says Carol A. Stepien, a fish geneticist at the University of Toledo in Ohio. Those diverse origins are preserved in today's bass, she and her colleagues reported in *Molecular Ecology* in 2007.

The fish in western Lake Erie are most genetically similar to those in Lake St. Clair, a small lake just upstream from there, the researchers discovered. And the fish in eastern Lake Erie are most genetically similar to those in Lake Ontario, which lies just downstream.

In the eastern part of Lake Erie, smallmouth bass are also more genetically diverse than their western companions, and fish from areas in between have intermediate levels of diversity. These trends suggest that eastern and central subpopulations of bass were geographically isolated from one another at some time in the past — a scenario also supported by sonar surveys. The data suggest that when Lake Erie was at its lowest level, around 8,800 years ago, what is today a large body of water would have been divided into two largely separate basins connected by a small waterway.

Smallmouth bass living in close proximity to each other might be expected to be genetically similar, says Stepien, because they typically don't migrate and often spawn in the same nesting sites each year. But more surprisingly, genetic analyses of walleye — a fish that remains generally faithful to its nesting sites yet spends much of its life in open waters, mixing with walleye from elsewhere in the lake — show similar trends in diversity.

So now findings from the disparate fields of genetics and geology, with a little archaeology thrown in for good measure, seem to be telling the same story: Once upon a time the Great Lakes, today one huge system linked by rivers and straits, were disconnected pools.

"I've been studying the Great Lakes for a long time, and there have been many puzzles," says Lewis, "but only now are things coming together and starting to make sense." ■

Explore more

- For the U.S. Global Change Research Program's report on climate and the Great Lakes, go to globalchange.gov and click on Midwest.

FROM LEFT: JEFF SCHMALTZ/MODIS RAPID RESPONSE TEAM/GSFC, NASA; LEWIS *ET AL.*/*EOS*

What do you see?

Emotion may help the visual system jump the gun to predict what the brain will see

ANSWER: Without context, many will conclude that the fuzzy image is the gun —the most emotionally evocative object shown.

By Jenny Lauren Lee

You are hiking in the mountains when, out of the corner of your eye, you see something suspiciously snakelike. You freeze and look more carefully, this time identifying the source of your terror: a stick.

Yet you could have sworn it was a snake.

The brain may play tricks, but in this case it was actually doing you a favor. The context — a mountain trail — was right for a snake. So your brain was primed to see one. And the stick was sufficiently snakelike to make your brain jump to a visual conclusion.

But it turns out emotions are involved here, too. A fear of snakes means that given an overwhelming number of items to look at — rocks, shrubs, a hiking buddy — "snake" would take precedence.

Studies show that the brain guesses the identity of objects before it has finished processing all the sensory information collected by the eyes. And now there is evidence that how you feel may play a part in this guessing game. A number of recent studies show that these two phenomena — the formation of an expectation about what one will see based on context and the visual precedence that emotions give to certain objects — may be related. In fact, they may be inseparable.

New evidence suggests that the brain uses "affect" (pronounced AFF-ect) — a concept researchers use to talk about emotion in a cleaner, more clearly defined way — not only to tell whether an object is important enough to merit further attention, but also to see that object in the first place.

"The idea here is not that if we both see someone smile we would interpret it differently," says Lisa Feldman Barrett of Boston College. "It's that you might see the smile and I might completely miss it." Barrett and Moshe Bar of Har-

OBJECT PHOTOS COURTESY OF M. BAR

vard Medical School and Massachusetts General Hospital in Boston outline this rather unexpected idea in the May 12 *Philosophical Transactions of the Royal Society B: Biological Sciences*.

Work connecting emotion to visual processing could have an impact on how scientists understand mental disorders and even personality differences, Barrett says. Some researchers say, for example, that autistic children might literally be failing to see critical social cues. The research might also have implications for understanding traits such as extroversion and introversion: Studies suggest extroverts may view the world through rose-colored glasses, seeing the good more than the bad.

Not-so-objective recognition

Scientists have long been interested in what role emotions play in recognizing objects, a process of perception that involves both collecting visual information about the world and higher-order workings of the brain.

It takes a few hundred milliseconds for the brain to come to a final decision about what the eyes see. But some basic information about an object — its shape and position in front of the viewer — are sent to the brain at warp speed. The general shape of a gun, for example, is similar to that of a hair dryer or power drill. Only with the additional processing time will the brain be able to confirm which of the three it is looking at. In the meantime, the get-it-quick part of the brain's visual-processing system can send enough information for the brain to take a good, if not always correct, guess at what it's seeing. This guessing process, called visual prediction, is attracting attention from scientists interested in understanding if and how emotion influences visual perception.

In the traditional view, perception, judgment and emotions are considered separate processes, with emotions coming last in the procession. One perceives. One judges, using reason, what best to do with the information collected. And one keeps one's emotions, as much as possible, out of the picture.

But in the early 1980s, some researchers began to think that affect plays an earlier role in object recognition. Researchers were struck by experiments in which people seemed to feel an emotion without being able to identify the object that had elicited it. In 1980 the late psychologist Robert Zajonc, then at the University of Michigan in Ann Arbor, wrote that it is possible that people can "like something or be afraid of it before [they] know precisely what it is." Other psychologists, including the late Richard Lazarus of the University of California, Berkeley, continued to advocate the traditional view. They held that rational thought was still the prime mechanism for identifying a baseball or telling an umbrella from a tree, and that emotion played a role only after visual processing was essentially complete.

Then work showed that emotions were important for a variety of processes that, like vision, had previously been thought to belong solely to the realm of cognition. In the mid-1990s, studies began to suggest that decision making, long held to be a prime example of a mental process best accomplished without the interference of emotions, could not only benefit from emotions, but also might require them.

Affect helps the brain weigh the value of objects, letting people know how to use or interact with what they encounter in the world. Simply seeing a banana does not tell you that you like bananas and want to eat one. The vision-processing areas of the brain are very "Spock-like," Bar says. They don't know what is good or bad, or important or unimportant. In the parlance of psychologists, it is affect that conveys that information.

"Without affect you might be dead very quickly," Bar says.

Affected perception

Whereas emotions describe complex states of mind, such as anger or happiness, affect refers to something much more basic. Psychologists describe it as a bodily response that is experienced as pleasant or unpleasant, comfortable or uncomfortable, a feeling of being tired in the morning or wound up at night. These responses are the ingredients for emotions, but they also serve as less complex feelings that people experience even when they think they feel "nothing."

"Affect is the color of our world," says psychologist Eliza Bliss-Moreau of the University of California, Davis.

Scientists are now learning that affect may play a fundamental role in object perception, regardless of whether the objects in question are "affective" or not. An inherently emotion-laden object like a gun or a basket of puppies — or a snake — would be expected to excite the emotion-processing areas of the brain. But even "neutral" objects such as traffic lights and wristwatches have been shown to trigger a certain amount of affect in people. For example, in a 2006 study published in *Psychological Science*, Bar and his then Harvard colleague Maital Neta showed that people appear to prefer smooth, curved objects over sharp-edged ones, though the people tested could not always articulate a reason for their preference.

"It has become pretty clear in the last 20 years that our judgments and ability to judge neutral information is contaminated — affected — by emotional values, by affective influences," Bar says.

Affect has also been shown to play a role in calling the brain's attention to important versus trivial objects, especially in terms of vision. Affect helps the brain prioritize.

"You enter a new scene, and there are vast amounts of information to analyze," Bar says. "Now you're drinking from a fire hydrant." People need something to tell them what is important. "If something looks sharp or snakelike or menacing, you stop analyzing the surface texture of the sofa," he says. Something with greater emotional relevance — positive or negative — takes priority.

The brain pays more attention to objects that evoke an affective response than it does to objects that don't have that "extra juice," says cognitive neuroscientist Luiz Pessoa of Indiana University Bloomington.

In binocular rivalry studies, two different images are shown to a viewer,

one image to each eye. Since the brain normally sees only one object at a time, attention switches back and forth between the two images. But in studies in which one of the two objects evokes an emotional response while the other does not (say, a fearful face and a neutral one), the evocative object holds the brain's attention longer. People actually report seeing that object more often than the neutral one. Writing in a 2006 issue of *Cognition and Emotion*, Georg Alpers and Paul Pauli of the University of Würzburg in Germany showed that objects associated with a positive or negative affect were seen first and for longer periods of time in the binocular rivalry studies than objects that evoked no emotion.

In *Emotion* in 2007, Alpers and his Würzburg colleague Antje Gerdes reported similar results for study volunteers viewing faces showing emotion versus faces with neutral expressions.

Studies from Barrett's group have recently gone a step further. Imbuing an object that normally would not evoke a feeling with an emotional charge in the laboratory gives the object an attentional boost, her team has found. In a paper published in *Emotion* in 2008, Bliss-Moreau, Barrett and Christopher Wright of Massachusetts General Hospital showed that when participants were shown emotionally neutral faces accompanied by a sentence of gossip, those faces elicited an affective response in participants. For instance, the face of a man who volunteers had been told once defecated on a crowded street was recognized faster than equally nonexpressive faces linked with more benign gossip.

A key question for many in the field is whether this redirection of the brain's resources happens early in the process of detection or later. Getting involved earlier could mean that affect helps the brain see things before they have been consciously seen. Affect could help the brain make predictions.

Guessing games

Your brain is constantly making predictions, many scientists think. But these are not the kind of predictions that let you bet on the winning horse or correctly divine that a meteor will hit the Earth in six years on a Thursday. It's a more basic, everyday kind of prediction, based on memories of past experience and available evidence.

Some of the best support for the view that affect might be involved in visual predictions, Barrett says, comes from the physical layout of the brain. Just as highways on a map show well-traveled routes between cities, nerve fiber pathways linking different parts of the brain hint at where high volumes of information pass through. In the human brain, one hub where nerve highways converge is the orbitofrontal cortex, or OFC, which lies behind the eyes.

The OFC has strong connections to the "get-the-gist-of-it" visual pathways that enable a person to identify low-level visual features of an object quickly. This hub also has connections to areas that bring in information about how the body is feeling, whether it is excited or uncomfortable or numb or in pain. Given these connections, the OFC could mediate an interaction between the quick, get-the-gist-of-it part of the visual pathway and the "how am I feeling right now?" parts of the brain, Bar and Barrett argue in their May paper.

And this connection might help the brain come up with a rough sense of what an object is before lower-level processing areas have finished passing on all that information to higher-level ones. This, Bar says, could be the route to a visual prediction.

Timing is also an issue. If affect has an

Context, affect and memory in visual prediction

The first steps in object recognition involve guesses informed by context, past experience and, new work suggests, emotion. Processing the details of shape and texture takes longer and happens after the brain makes an initial judgment about what something is.

See a gun. The eyes send detailed information about an object to the vision-processing areas of the brain.

Get the gist of it. General info about the shape is processed very quickly, forming a low-resolution image of an object in the brain.

Tap memory banks. The brain compares the bare-bones view with memories of objects of a similar shape.

Add context. What you see depends partly on whether you're at a salon, crime scene or carpenter's shop. But mood and experience also play a role.

SOURCE: FENSKE *ET AL./PROGRESS IN BRAIN RESEARCH* 2006; OBJECT PHOTOS: M. BAR; KEVINRUSS/ISTOCKPHOTO; KARENMOWER/ISTOCKPHOTO; FERRANTRAITE/ISTOCKPHOTO

early influence on perception — within the first 60 to 120 milliseconds after a person's eyes see an object — then it could indeed have an effect on the brain's predictions. But studies that try to gauge the speed of the brain's affective response have produced a range of results, showing activity as early as 30 milliseconds and as late as more than 200 milliseconds after a visual stimulus is shown. The variability has made it difficult to pin down exactly when affect may play a role, Pessoa says.

Still, some studies do suggest an early role for emotion in vision. Pessoa and his Indiana University colleague Srikanth Padmala led a study that trained volunteers to associate an emotion with a textured pattern by pairing an image of the pattern with a mild electric shock. Volunteers were then shown these textured patterns along with other, novel patterns that had not been associated with the shocks. Researchers observed the volunteers' brain activity using functional MRI as both sets of patterns were shown faintly on a screen for a mere 50 milliseconds.

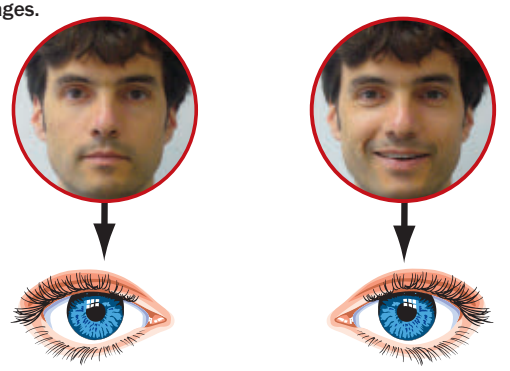
The subjects said they did not see the affect-free patterns but did report seeing the patterns that had been paired with the electric shocks. Functional MRI confirmed the reports: Early vision-processing areas of the brain that are involved in the first levels of identifying objects were indeed lighting up when people said they saw the patterns, the researchers reported in 2008 in the *Journal of Neuroscience*.

People's moods also may influence what they see and don't see. Barrett's group is now investigating how a person's mood impacts whether faces showing positive or negative emotion get more or less attention. In an ongoing binocular rivalry study, researchers put people into either a negative or positive state of mind by showing them disturbing or uplifting pictures, or asking them to remember a sad or happy experience. Subjects are then shown an image of an emotionally expressive face in one eye and a neutral house in the other. Preliminary results suggest that people in a low mood see all the faces, both positive and negative, instead of the house. But people in a good mood see the happier faces instead of the house more often than they see the sad or angry ones. The results suggest that changing people's moods may change how the brain processes information.

Emotional appeal

You have two eyes but only one brain. When two different images are presented, one to each eye, the brain normally views one image at a time. Scientists make use of this effect — called binocular rivalry — in studies that probe how factors like emotion impact the brain's prioritization of visual images.

What the eyes see
In one experiment, researchers showed volunteers an image of an actor portraying a neutral face in one of their eyes and an image of the same actor with a happy or sad face in the other eye. The subjects were asked to indicate which image they saw and when that image switched.



What the brain sees
As volunteers watched the two images, their brains shifted attention back and forth between the views. Sometimes subjects saw the emotional face, sometimes the neutral one and occasionally a mixture of the two. But the emotional faces tended to dominate, often being the first of the two images that participants reported seeing and the most-often viewed.

Visual impact

To Barrett, getting a better handle on the relationship between seeing and feeling has the potential to improve understanding of many different disorders. "You can't find a mental illness that doesn't involve some problem with affect," she says.

For example, some researchers think autism might be related to an inability to pay attention to the right social cues. "It's possible that kids with autism have checked out of the social environment because they physically don't see social cues," says Bliss-Moreau, who is part of a team that studies macaques with brain lesions to learn about disorders such as autism. "Or they see the cues but don't encode them correctly."

For people with autism, a facial expression showing emotion may not have the same value and meaning that most others learn to associate with it, and as a result may not dominate the vision-processing centers of the brain as much as it would in a person without the disorder.

Anxiety, depression and even extroversion and introversion could be far better explained in terms of what people perceive, rather than in terms of their behavior, Bliss-Moreau contends.

After all, it appears that whether you see the stick or the snake depends on your mood as well as your past experiences.

"How you sample information from the world, and understand what it means, is going to be different" depending on all these factors, Barrett says. "It's literally going to change what you see." ■

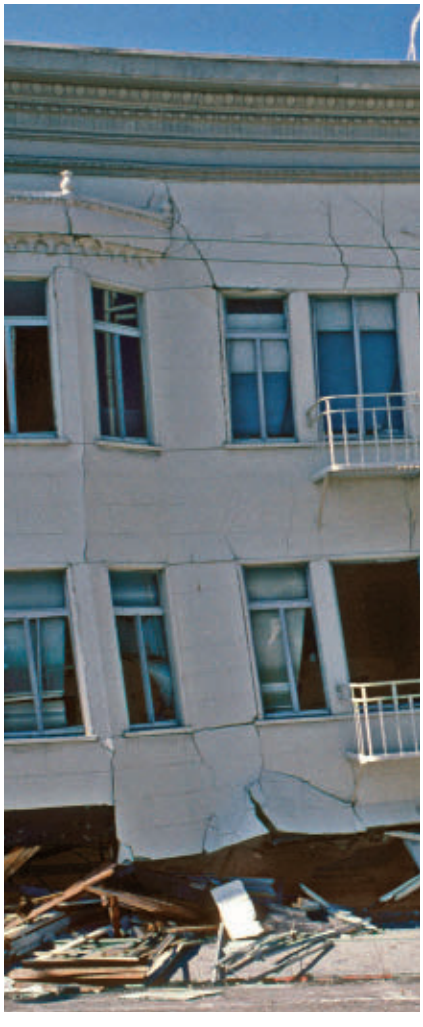
Explore more

- L.F. Barrett and M. Bar. "See it with feeling: Affective predictions during object perception." *Philosophical Transactions of the Royal Society B*. 2009.

FACES: A. GERDES; EYES: POWERLINES/ISTOCKPHOTO

Despite past failures, geophysicists think earthquake prediction might yet be possible By Kristina Bartlett Brody

SHAKY FORECASTS



GARRY GAY/GETTY IMAGES

A possible advance sign of the Loma Prieta quake (aftermath, left) now appears to have been a sensor malfunction.

Jeff McGuire says he does not want to be known as the guy who predicts earthquakes. But in September 2008, a magnitude 6.0 quake shook the bottom of the ocean at a fault along the East Pacific Rise — less than 30 kilometers from where and within the year-and-a-half window that McGuire and his colleagues had predicted.

It is in fact possible to predict a large quake on a short timescale, says McGuire, of the Woods Hole Oceanographic Institution — when the geology is relatively simple, as on a transform fault along the East Pacific Rise. And his year-and-a-half time frame is short compared with the typically decades-long forecasts for large earthquakes on other types of faults.

On the continents, however, the geology is not so simple. Most big quakes happen at the boundaries between oceanic and continental plates, on faults known to have experienced big quakes in the past. Yet some of the largest quakes in the United States happened nowhere near a plate boundary, and some big quakes have occurred where no fault had previously been known to exist. Decades of false starts and failures have led many experts to conclude that making accurate short-term predictions of those rare but big earthquakes is a hopeless quest.

"We understand the complexity of

earthquakes," says David Jackson, a seismologist at the University of California, Los Angeles. "Big ones start as little ones and find enough energy to keep going." Figuring out when big ones are going to happen requires knowing much more about how quakes begin, and also about how big they will grow once they start.

"It may be that the amount of information that we need to have about the fault to predict how big an earthquake will grow is, for all practical purposes, unknowable," says geophysicist Greg Beroza of Stanford University. "Still, until we have a deeper understanding of fault behavior, I think it's important to keep an open mind."

More and more researchers' minds have been opening. While scientists aren't exactly optimistic, some of their pessimism about prediction is fading, says Susan Hough, a seismologist in the U.S. Geological Survey's Pasadena, Calif., office. "There's a lot more talk in serious seismology circles about prediction."

Fueling the new attitude are tools, knowledge, technologies and data that researchers didn't have before, says Mike Blanpied of the USGS Earthquake Hazards Program and the National Earthquake Prediction Evaluation Council. Some 4,000 stations, for example, now monitor Earth's known faults. Global Positioning Systems constantly watch the ground move. Instruments that measure tiny changes in strain and motion deep underground are embedded in some of the world's most dangerous faults. And computers store and process huge data sets on it all.

These ingredients add up to a perfect recipe for a mathematical approach to understanding earthquakes — and offer the intriguing possibility that a quantitative picture of the ways quakes change how rocks share and trade stress underground could help in determining when a small quake will become a big one.

"There's a lot of data now to work with that didn't exist earlier," Blanpied says.

Prediction predicament

Many seismologists maintain that providing absolute, short-term prediction of a big quake in a specific place is not possible. "Scientific focus is better directed at long-term forecasts to improve the information that goes into building codes and insurance rates," says David Applegate, senior science adviser for earthquake hazards at USGS in Reston, Va. Other researchers are focused on developing early warning systems, already deployed in Japan, which detect an earthquake's early seismic waves and give people crucial seconds of notice before shaking begins. But other experts can't resist pursuing the idea that a week's, month's or even year's warning of a large quake might be possible.

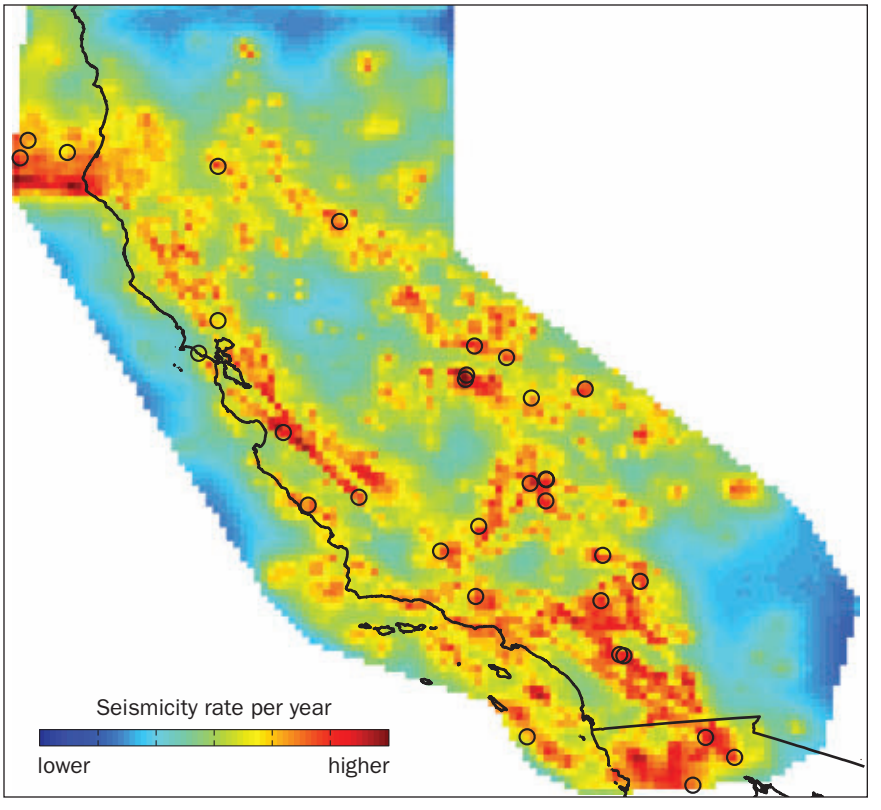
One session at a meeting this year of the Seismological Society of America was titled "Global Collaborative Earthquake Predictability Research," the mission of an international research consortium now in its third year. The goal of the group, the Collaboratory for the Study of Earthquake Predictability, is to standardize and make more scientific the way earthquake predictions are stated and tested, says its director, Tom Jordan of the University of Southern California in Los Angeles. The group also aims to continuously monitor faults around the world and test how well statistical, quantitative models of earthquake likelihood hold up to what happens in real time. One testing center was set up at USC three years ago.

Not long ago, "earthquake" and "predictability" would have been unlikely adjoining words in a seismological society session. Long faded was the excitement created by the apparently successful prediction of a magnitude 7.3 quake that struck Haicheng, China, in 1975.

"It was kind of a successful prediction," Hough says, "although it turns out, when you dig into it, it was largely a matter of luck."

Long-term seismocast

In a new quake prediction approach, scientists consider an area's total, ongoing seismic activity rather than basing forecasts on individual fault histories. One such model suggests that the pattern of small earthquakes foretells the pattern of large quakes. This map forecasts probabilities per year for quakes exceeding magnitude 5 in California (circles indicate previous such quakes).



HELMSTETTER *ET AL./SEISMOLOGICAL RESEARCH LETTERS* 2007

Inspired in part by the Haicheng prediction, the U.S. government started the National Earthquake Hazards Reduction Program and billed it largely as a prediction program, says Hough, who is writing a book on quake prediction.

But during the 1980s and 1990s, geologists' pessimism about the feasibility of prediction grew. "Earthquakes happened that hadn't been predicted," Hough says.

Still, researchers kept looking for clear precursor signals. For example, since the 1970s some researchers have explored the idea that the ground releases unusual amounts of radon gas before a quake starts. But sometimes the gas release precedes large quakes, and sometimes it doesn't, Applegate says. Similarly, the premise that underground changes create low-frequency magnetic waves detectable in the atmosphere gained wide favor after a reported magnetic signal for the magnitude 6.9 Loma Prieta earthquake that shook the San Francisco Bay Area in October 1989. But a new analysis of that data in the April *Physics of the Earth and Planetary Interiors* concludes that the signal was the result of a malfunctioning amplifier on a sensor.

The main problem with earthquake predictions, however, is getting the time right. "We think we're probably doing an OK job of identifying where earthquakes are likely to occur and probably pretty well on what the largest magnitudes are expected to be for a particular fault for a particular area," Blanpied says. "We've even been able to get the long-term rate of earthquakes. But saying when a particular earthquake is going to occur has really not ever been done."

Shakes before quakes

Many seismologists have turned to assessing various factors, rather than searching for any one sign. One idea is that patterns of small quakes, which rattle the Earth every day, contain information about dynamics around faults and within rocks.

"There's this appreciation that the big ones grow out of the little ones, and that the little ones redistribute the stress," says UCLA's Jackson. "They set up the stress for the big ones."

Much of the current work aims to decode how stress is distributed and redistributed far below the surface and among more than one fault in an area. Understanding that pattern could help scientists recognize when stress is setting the stage for a large quake.

In 2000, Jackson and several colleagues proposed the Regional Earthquake Likelihood Model, or RELM, as a method for testing forecasts of earthquake odds. RELM allows probabilities to be tested not along one fault, but by units of location, magnitude and time. A modeler divides an area into grids of projected probability. From there, the model can be measured against what actually happens over time in the area, and also measured against other models of probability. "RELM is flexible precisely because it is a blank sheet," Jackson says. "Put probabilities in, and see whether future earthquakes occur in the high or low probability areas you specified."

A former postdoctoral researcher with Jackson, Agnès Helmstetter, now at the University of Grenoble in France, used the RELM approach to suggest that an area's distribution of past seismicity, including quakes as low as magnitude 2, can be a map for predicting future large earthquakes. Her application of RELM is one of the models being compared against real-time measurements of ongoing seismic activity around the collaboratory's first testing center at USC.

So far, Helmstetter's application of the model is proving robust against almost three years of seismic measurements, Jackson says. One possible reason is that she is using a large amount of seismic data.

"Forecasts based on past seismicity may provide more accurate forecasts than models based on geological data — fault location and slip rate — because many faults are not known, or spatial resolution is not as good as seismicity data," Helmstetter says.

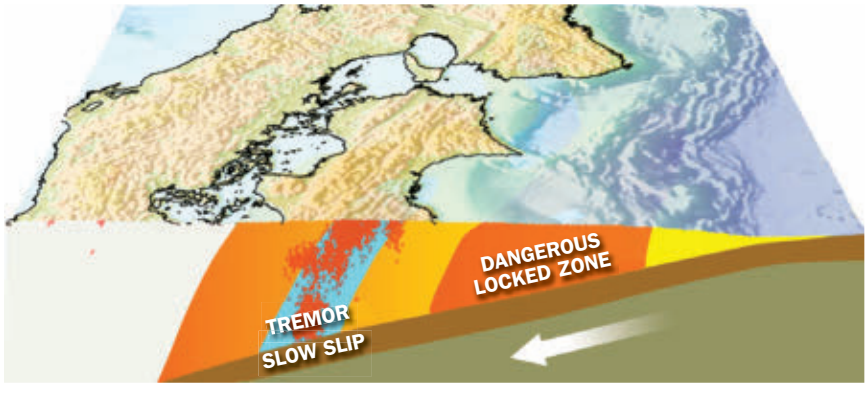
The most hopeful lead for specifying earthquake location and likelihood, Jackson says, is the observation that earthquakes cluster. Such a swarm, a sudden jump in the number of small quakes in one area, clearly signaled the magnitude 6 quake on the East Pacific Rise fault, McGuire says. "The fault kind of turned on for a few days," he says.

Possibilities and probabilities

On the continents, the picture isn't as clear. Take central Italy, where small quakes began shaking in December 2008. By April, 400 small and medium quakes — including one at magnitude 4.5 in March — had added to the swarm. The Istituto Nazionale di Geofisica e Vulcanologia, or INGV, in Rome now estimates that the chances of a large, damaging quake were between 0.1 percent and 0.3 percent for any given week at that time.

Slow-tempo temblors

Slow earthquakes (red dots in blue zone) are common where the Philippine Sea Plate dives beneath southwestern Japan. These quakes occur too slowly to create seismic waves but affect the way stress is distributed beneath faults, offering a way to investigate events leading to large quakes. The "locked zone" shows where rupture occurred during large quakes in 1944 and 1946.



BEROZA AND IDE/*SCIENCE* 2009

Meanwhile, along the southern portion of California's San Andreas fault, seismometers were measuring a similar earthquake swarm around the town of Bombay Beach, just south of the Salton Sea, with a magnitude 4.8 quake hitting on March 24. Soon after, the Southern California Earthquake Center announced that chances of a large earthquake striking were 1 to 5 percent over the coming days.

No large quake struck the Bombay Beach area. But on April 6, a magnitude 6.3 quake hit Italy, with its epicenter near the town of L'Aquila. The damage was severe, mainly to old buildings not constructed to withstand shaking. Almost 300 people were reportedly killed.

"Even though the probabilities go way up, they are still low," Jordan says. "So it's hard to know exactly what to do in terms of advising people. Chances are nothing is going to happen. But in the case of Italy, it did."

Warner Marzocchi, a chief scientist at INGV, says using earthquake swarms as clues to big quakes is a promising technique. But it's far from a sure thing. "If you think this swarm was enough to raise an alarm, you would have to raise a lot of alarms," he says of the small quakes preceding L'Aquila. Similar swarms occurred in previous years, he says, with no big quakes.

Massimo Cocco, also at INGV, notes that a claim that the L'Aquila earthquake had been predicted was of little merit. "There was no prediction for this earthquake. There was a claiming, but it was not released in a way that can be evaluated scientifically."

Such supposed quake predictions are among the reasons Jordan and his colleagues started the collaboratory. Part of the group's mission is to infuse rigor and standardization into earthquake prognostication, so that predictions are spelled out — with a specific geographical location, time and magnitude range — as scientific hypotheses that can be tested.

Central Italy will be one of the testing sites for the collaboratory, Jordan says. And researchers are already applying the RELM model to the L'Aquila aftershocks, Cocco says, to better understand how the main shock affected stress in the surrounding rock.

Cocco adds that several hundred of the swarm quakes were clustered near the April 6 quake's nucleation, the area in a fault where an earthquake begins. "We need to work more to understand the nucleation and the physical processes responsible for earthquake initiation," he says.

The early buildup

The nucleation — the start — of earthquakes could be slow.

Strain builds as plates press each other and try to slide past one another over hundreds of years. At a fault — a weak point in the crust — the strain eventually overcomes the friction between the plates. This sudden frictional failure, or rapid fault slip, happens in seconds and generates seismic waves that travel through rock. In large earthquakes, fault slip may reach the surface.

Experts can't say when the Big One will hit, even for the famous San Andreas fault.

ROBERT E. WALLACE/USGS

In 1995, Beroza and William Ellsworth, also of Stanford, proposed a possible transition period between the gradual building of strain and the sudden slip. It is a slow preparation process, the tail end of which generates a seismic signal, Beroza says. The duration of the process could correspond to the size of the resulting earthquake.

This transition process could be related to another phenomenon exciting earth scientists. In 2002, Kazushige Obara, using data from intensive earthquake monitoring in Japan after the 1995 Kobe quake, reported that slow, almost imperceptible movement happens within portions of faults deep below where earthquakes occur. These changes, detectable only with the most sensitive instruments that discern tiny movements in rock, are too slow to generate strong seismic waves. Earth scientists studying this subtle movement use terms such as *slow quakes, silent quakes, aseismic slip, nonvolcanic tremor, slow transients* and *episodic tremor and slip.*

Researchers are only beginning to grasp the slow quake phenomenon. "It has not taught us much about garden-variety earthquakes," says geophysicist John Vidale of the University of Washington in Seattle. But he adds that "tremor has the potential to silhouette patches that will break in future earthquakes. In the Pacific Northwest, for example, the location of tremor suggests that the next magnitude 9 earthquake in the region can break closer to the Puget Sound than we previously thought."

Beroza says the slow quakes detected so far haven't been followed by any large earthquakes, but notes that seismologists have been watching these silent quakes for only eight years. The quakes do increase stress on the faults. A team reports in the May 26 *Eos* that monitoring slow quakes in a subduction zone around the state of Guerrero in Mexico could offer a way to understand how stress is being distributed among different parts of the fault. "As it gets closer to the time of the big earthquake," Beroza says, "the character or the frequency of the slow earthquake might change."

The new understanding might reveal a possible precursor pattern for large quakes. Or it might not.

"People need to realize that some natural events like earthquake occurrence have a probabilistic nature," says Marzocchi of Italy's INGV. "We may not be able to predict earthquakes. We may only be able to make forecasts." ■

Explore more

- Visit the Collaboratory for the Study of Earthquake Predictability website: www.cseptesting.org

Life Ascending: The Ten Great Inventions of Evolution

Nick Lane

Since Charles Darwin sketched out evolution's process 150 years ago, a landslide of data has swept scientists into a more detailed understanding of how life's variety emerged. In *Life Ascending*, Lane, a biochemist, describes how 10 evolutionary inventions transformed the living world. These "inventions" — a term Lane uses to convey the astonishing creativity of nature, not the idea of deliberate creation — result from natural selection, he contends, the driving force behind Darwinian evolution.

In chapter-length treatments, the author engagingly blends background information on the discovery and function of each invention with data from the latest analyses and experiments. The first great invention, life itself, may have developed billions of years ago at hydrothermal vents dotting the ocean floor, Lane recounts. He walks readers through the process by which DNA, another invention, enabled an organism to pass genetic material to its offspring. And he explains how photosynthesis enabled some organisms to glean energy from sunlight, supercharging Earth's atmosphere with oxygen in the process.

Other inventions include the complex cell (which includes a nucleus and various organelles), movement (which allows animals to roam in search of food) and sight (an ability so important that 95 percent of all modern-day animal species possess it). Warm-bloodedness, consciousness, sex and death round out Lane's tally.

Besides documenting evolution's major innovations, *Life Ascending* offers a fascinating look at how scientists have come to understand evolution with an ingenuity rivaling that of nature herself. — *Sid Perkins*
W.W. Norton, 2009, 344 p., $26.95.

Dark Side of the Moon: Wernher von Braun, the Third Reich, and the Space Race

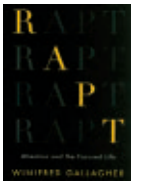
Wayne Biddle

Though rocket scientist Wernher von Braun is championed for helping propel the United States to the forefront of the space race, his ties to the Nazis in his native Germany make him deserving of censure, Biddle argues in *Dark Side of the Moon*. In this account of von Braun's rise to scientific prominence, Biddle posits a central question: To what extent should scientists be held responsible for the use or misuse of their expertise?

Von Braun surrendered to American forces shortly before World War II ended, subsequently moving to the United States to assist scientific efforts there. When later asked about his role in developing and producing the V-2 rockets used against Allied forces, von Braun said his focus was solely space travel.

But on the basis of declassified archival material and interviews with survivors of the Nazi labor camp where these rockets were produced, Biddle portrays von Braun as an opportunist who fully understood and accepted his orders to produce weapons, not spaceships. The scientist was also far more aware of atrocious conditions in the V-2 factory than he would later admit, Biddle contends.

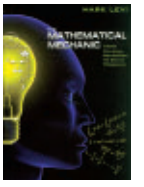
Biddle richly details von Braun's youth and life during World War II and the bumpy road to the V-2's development. But Biddle fails to fully support one of his major points — that America's obsession with beating the Soviets in the space race allowed von Braun to whitewash his past association with the Nazis. Still, Biddle succeeds in creating a more nuanced portrait of an American space "hero" and forcing the reader to contemplate scientists' ethical responsibilities. — *Rachel Zelkowitz*
W.W. Norton, 2009, 198 p., $26.95.



Rapt: Attention and the Focused Life

Winifred Gallagher

Reality consists of what you pay attention to, and new research is unraveling how the brain chooses some things over others. *Penguin Press, 2009, 256 p., $25.95.*



The Mathematical Mechanic: Using Physical Reasoning to Solve Problems

Mark Levi

A Pennsylvania State University professor reveals how physics can simplify proofs, illustrate theorems and offer quick mathematical solutions. *Princeton Univ., 2009, 186 p., $19.95.*

Summer World: A Season of Bounty

Bernd Heinrich

A naturalist's observations reveal that the animal world is abuzz with activity during the summer. *Ecco, 2009, 253 p., $26.99.*

Kinematics: The Lost Origins of Einstein's Relativity

Alberto A. Martínez

This often-overlooked branch of mechanics, which describes objects' motion, provided the foundation for special relativity, a historian argues. *Johns Hopkins Univ., 2009, 464 p., $65.*

The Wonders Inside: Bugs & Spiders

Jan Stradling

Illustrations for a young audience detail the anatomy and the ecosystems of these creatures. *Silver Dolphin Books, 2009, 90 p., $19.95.*

How to Order To order these books or others, visit www.sciencenews.org/bookshelf. A click on a book's title will transfer you to Amazon.com.

Conspiratorial skepticism

After achieving two degrees in psychology, I concluded that the field is largely bereft of genuine insight and simple common sense, and that it masquerades as a science, with notable exceptions here and there. Articles such as "Tracing the inner world of suspicion," (*SN: 6/20/09, p. 11*) confirm and underline psychology's essential mindlessness. For one thing, the investigators cited in the article contrived a spurious category: that there is a personality given to forming conspiracy theories, and they can be identified by certain traits (none of which, as it turns out, have anything to do with the reliability or the lack thereof of the sources of their information). Secondly, the investigators proceeded on the bogus assumption, unstated but implied, that our sources of information via the mainstream media are accurate and completely truthful. Ergo, conspiracy-theory thinking is somehow an affliction of some sort — what's wrong with those people that they could think like this? This is but one small step from the use of psychology in Stalinist Russia to send dissidents to Siberia, declaring them insane. Sadly, the field of psychology is replete with this sort of ill-conceived claptrap.

David J. Zaido, Webster, Mass.

I found the article "Tracing the inner world of suspicion" uncomfortably close to politics. A scientific article illuminating a particular conspiracy theory, such as 9/11, is very appropriate for *Science News*. However, this article was aimed at conspiracy theorists in general and, by extension, all conspiracy theories. History is nothing more than the story of conspiracies, from the conspiracy to kill Caesar to Hitler's takeover of Germany, to name a few.

Jacques Middlecoff, Boulder, Colo.

Cosmic carbonation

After reading Tom Siegfried's wonderful article ("Infinity," *SN: 6/6/09, p. 26*) on multiple universes and inflation theory, I was watching the carbonated bubbles appear in my beverage and wondered if the "entities" living in the film of those bubbles would have any understanding of the carbonation causing their universe to expand until it bursts or merges with another universe. Is our universe nothing more than a bubble in some cosmic beer mug?

Larry D. Rex, Santa Clara, Calif.

Send communications to:
Editor, Science News
1719 N Street, NW
Washington, D.C. 20036
or **editors@sciencenews.org**
All letters subject to editing.

Clyde W. Yancy

For more Comment, visit COLUMNS at **www.sciencenews.org**

Balancing gains and threats in cardiovascular care

Clyde W. Yancy, a cardiologist and medical director of the Baylor Heart and Vascular Institute in Dallas, became national president of the American Heart Association on July 1. He recently spoke with Science News *writer Nathan Seppa.*

Dramatic gains in cardiovascular care in the United States risk being negated by an epidemic of obesity, diabetes and other conditions. How do you see us navigating these crosscurrents?

This is the dichotomy of influences under which we currently exist in the cardiovascular community. Heart disease and stroke continue to be leading causes of death in this country. But the fact is, we've seen a dramatic shift in the natural history of cardiovascular disease and strokes. Since 2000, there's been a 30 percent decline in death due to coronary heart disease and a 26 percent decline in death due to strokes.

These are truly heroic steps that are in part attributable to scientific developments and advances made in urgent care. One area where we've improved is secondary prevention. For example, in heart attacks, we've developed a very good understanding of how to prevent a second one. That applies to strokes, too.

But while we've done a great job recognizing ... heart disease, you can argue that's too late in the process.... Fortunately, we are becoming more facile in primary prevention. If we reduce blood pressure, encourage exercise and get people to stop smoking, we can interrupt the development of disease. And not surprisingly, but unnoticed by many, at least half of the reductions in cardiovascular and stroke deaths is from better control of risk factors. We know primary prevention works. But we need to do it better.

Meanwhile, there is another set of indicators that are very compelling and, quite frankly, disturbing. We run the risk of having the first generation of Americans who will experience a state of health that is worse than the previous generation's. The implicit contract made from one generation to the next, that life will be better, is at risk of being broken.

This is almost entirely due to the burden of obesity in the community. Obesity science is complex. It's not just calories in, calories out, but rather a matrix of factors — physiological, societal, ecological and economic. Any effort to affect obesity can't just be put on the back of the individual.

We run the risk of having the first generation of Americans who will experience a state of health that is worse than the previous generation's.

How do you see health care reform affecting cardiovascular care?

We've got to get health care reform through. Everything comes at a cost, but there will be a greater cost if we're unsuccessful. The uninsured and the underinsured are affected disproportionately by today's health care environment. Science and new discovery are similarly impeded by the lack of sustained investment in new technologies and new discoveries. Best practices are not always being followed....

I see opportunities here, an environment in which we will reach many more people affected by cardiovascular disease and stroke who are currently out of the loop. As the leading cause of death and disability in this country, cardiovascular diseases, including stroke, will be leading indicators of the success or failure of health care reform. At the AHA, we are deeply invested in health care reform and will continue to take a patient-centric view that advocates for accessible, affordable and adequate care for all.

Stroke continues to be a problem in this country. Where is stroke care headed?

Stroke by itself is the third leading cause of death and especially [of] disability in this country. Every 40 seconds a stroke occurs and 20 percent of strokes result in some form of institutionalized care. But stroke care is evolving; therapy at the time of the acute event can result in dramatic improvements in stroke outcomes and the secondary prevention measures are quite effective. Here are the two near-term challenges: We need to elevate the awareness of stroke and ... stroke symptoms and we need to vigorously target the risk factors for stroke. Exciting research is ongoing to better preserve neurological function at the time of the event and, hopefully one day, to restore function in stroke victims....

In the Internet age, patients go online and gather advice on medical matters. How do doctors contend with that?

The information age makes it both easier and harder for doctors. It's easier because it completely obliterates any barriers we've had about access to information. But it makes it harder because now patients and physicians have to adjudicate the information received. What is the quality of this information? What is its origin? All of us in the various areas of science and health have a responsibility to separate the noise from the information. That is no easy task. ■

AMERICAN HEART ASSOCIATION, AMERICAN STROKE ASSOCIATION

No Contract

Bigger, Brighter screen. Large, backlit numbers.

It doesn't play music, take pictures, or surf the Internet.

NEW and IMPROVED

Introducing the NEW Jitterbug®. It's the cell phone that offers simplicity for everyone.

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 lots of complicated features. They are hard to use, and hard to see. 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 the New Improved Jitterbug?

Try our pre-recorded Toll-Free Hotline 1-877-651-0847.

The new Jitterbug cell phone makes calling simple!

- Bigger, Brighter LCD screen... easier to see even in daylight
- Comes pre-programmed and ready to use right out of the box
- No contract required
- Live, 24-hour Jitterbug Operators greet you by name, connect calls and update your Phone Book[1]
- Soft ear cushion and louder volume for better sound quality
- Comfortable keypad designed to make dialing easy
- Hearing aid compatible – top ratings in this category
- Familiar dial tone confirms service (no other cell phone has this)
- Service as low as $14.99* a month

100% U.S. Based Customer Service

Available in White and Graphite.

Why pay for minutes you'll never use!

Monthly Minutes†	50	100	New
Monthly Rate*	$14.99	$19.99	New
Operator Assistance	24/7	24/7	
911 Access	FREE	FREE	
Long Distance Calls	No add'l charge	No add'l charge	
Voice Dial	FREE	FREE	
Nationwide Coverage††	Yes	Yes	
Trial Period	30 days	30 days	

Other plans available. Ask your Jitterbug expert for details.

FREE Gift

Order now and receive a free Car Charger. A $24 value![5]

Service as low as $14.99* 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

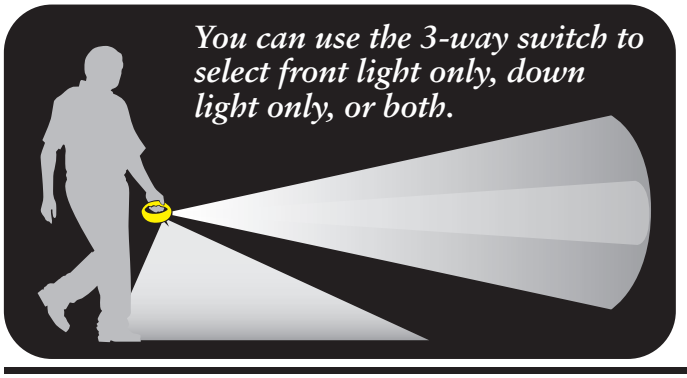
Jitterbug Cell Phone
Call now for our lowest price.
Please mention promotional code 38492.
1-888-824-0564
www.firststreetonline.com

47349

IMPORTANT CONSUMER INFORMATION: Subject to Customer Agreement, select calling plans and credit approval. Other changes and restrictions may apply. [1]For each Operator service, you'll be charged a 5-minute "Operator assistance fee" in additional to the minutes used both for the length of the call with the Operator and any call connected by the Operator. *Not including surcharges and government taxes. †All plans require the purchase of a Jitterbug phone and a one-time set-up fee ($35). ††Coverage and service not available everywhere. [5]This GreatCall offer is available for a limited time only. **Please visit www.jitterbug.com for further information about terms and conditions.

Nightlighter lights the way ahead and the path at your feet

Walking is great exercise, but it shouldn't be hazardous to your health. If you like to walk early in the morning or at night, you know how important it is to be seen… and to see what's ahead. With a normal flashlight, you have to continually flip the beam down to the ground in front of you to see any impediments in your path. Now, a simple yet innovative solution is sweeping the country. The Nightlighter Flashlight features an ultra-bright LED spotlight that shines ahead while the LED floodlight illuminates the area at your feet. Its ergonomic oval design and lightweight body make the Nightlighter well-balanced and easy-to-carry. LED technology provides exceptional battery life (10x longer than traditional flashlights) making sure you have light when you need it most! The shockproof LEDs will never burn out, and you can use the 3-way switch to select front light only, down light only or both.



We are so sure the Nighlighter will make walking safer and more fun that we are offering it to you at a special low price with our exclusive home trial. Try it for yourself, and if you are not completely satisfied for any reason, simply return it within 90 days for a full refund of the purchase price "No Questions Asked." Call today!

Nightlighter Flashlight

was . . . ~~$29.95~~ **Now . . . $19.95** + S&H

We accept all major credit cards, or if you choose, you can pay by check over the phone. To order by mail, please call for details.

Please mention promotional code 38493.
For fastest service, call toll-free 24 hours a day.

1-888-763-5153

www.firststreetonline.com

firstSTREET
for Boomers and Beyond®

1998 Ruffin Mill Road
Colonial Heights, VA 23834

48551