JUNE 3, 2006 PAGES 337-352 VOL. 169, NO. 22

# SCIENCE NEWS

E WEEKLY NEWSMAGAZINE OF SCIENCE

climatic boon for poison ivy

elderly, iron-poor blood

novel instrument's rich sound

how a virus lurks

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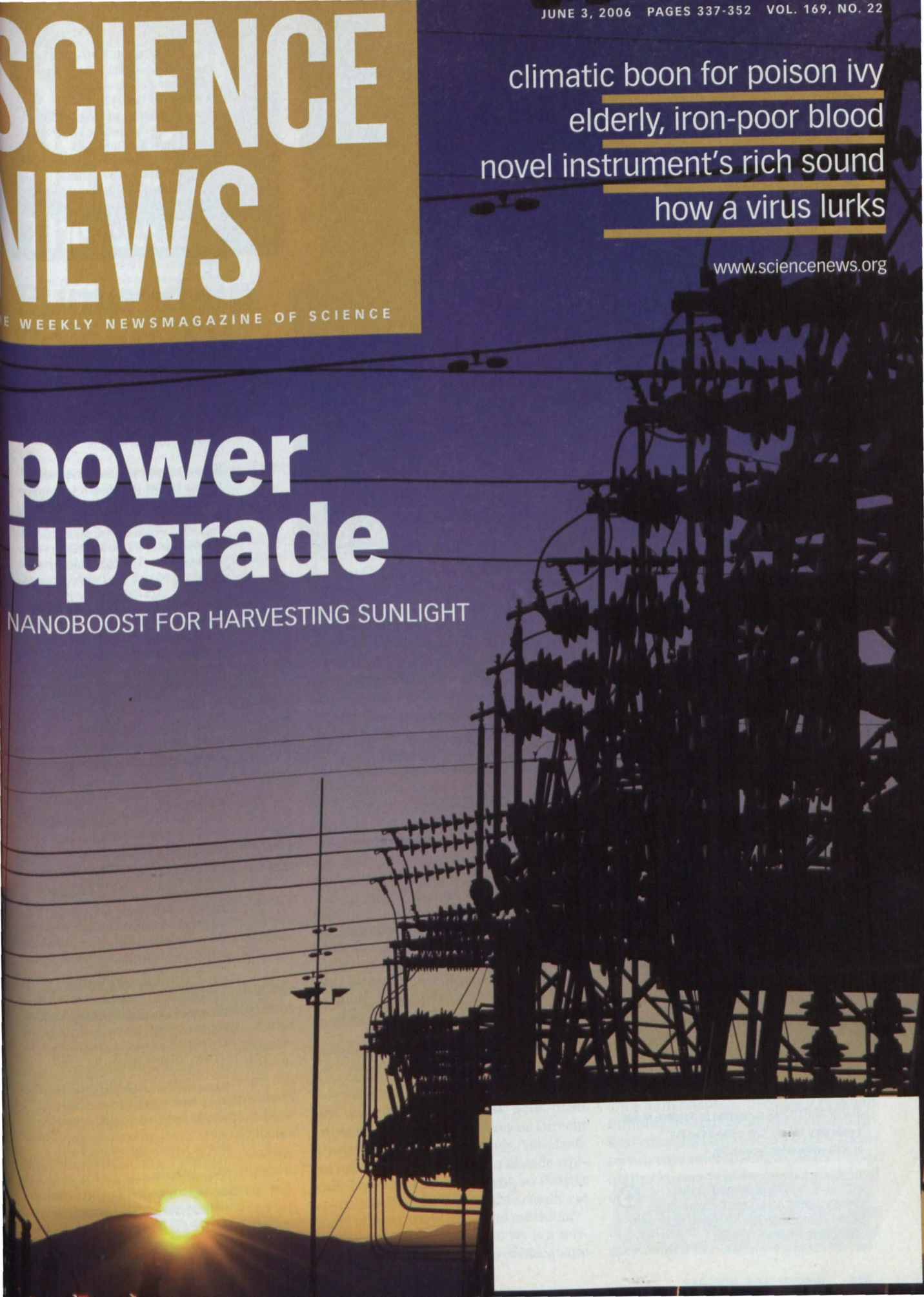

# power upgrade

NANOBOOST FOR HARVESTING SUNLIGHT

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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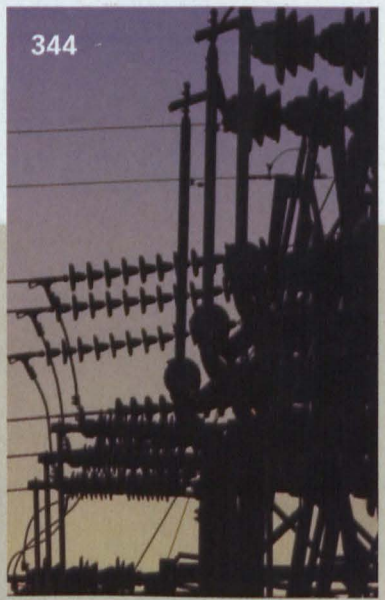


## Features



## This Week



## Of Note



## Departments



**Cover** Turning from conventional power sources to solar power, scientists are using tiny semiconductor crystals, or quantum dots, to take advantage of energy wasted by today's photovoltaic cells. As researchers strive to exploit this newfound economy, they're quarreling about how quantum physics might explain it. (J.E. Smith/Los Alamos National Laboratory) Page 344



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# Pumped-up Poison Ivy

## Carbon dioxide boosts plant's size, toxicity

**BAD VINES** Poison ivy grows unusually fast when carbon dioxide in the atmosphere reaches concentrations expected in forests by about the year 2050.

**Whatever troubles climate change might** bring to the world's other species, rising carbon dioxide in the atmosphere could be the best thing yet for poison ivy.

An outdoor experiment mimicking the carbon dioxide rise predicted for this century found that poison ivy vines grew more than twice as much per year as they did in unaltered air, says Jacqueline E. Mohan, now of the Marine Biological Laboratory in Woods Hole, Mass. That growth streak is nearly five times the increase reported for some tree species in other analyses.

More bad news: The jolt of carbon dioxide also boosted the most-toxic forms of poison ivy's rash-raising oil, Mohan and her colleagues report in an upcoming *Proceedings of the National Academy of Sciences*.

"It's a sobering example that rising carbon dioxide can favor pests and weeds, those plants we'd least like to see succeed," comments climate-change ecologist Bruce Hungate of Northern Arizona University in Flagstaff.

People burning fossil fuels release carbon dioxide into the atmosphere. As the atmosphere gains carbon dioxide and other so-called greenhouse gases, it traps more of the sun's heat.

Biologists have wondered whether this carbon boost might work as aerial fertilizer for plants. Earlier lab experiments found plants growing exuberantly with extra carbon dioxide, but these tests provided abundant water and nutrients.

For more-realistic tests, researchers have set up treetop-high pipes that blow either regular air or extra carbon dioxide over landscape patches in various ecosystems around the world. For 6 years, Mohan and her colleagues monitored poison ivy and the other plants growing within circles of such pipes in a pine forest monitored by researchers of Duke University in Durham, N.C.

The poison ivy vines thrived with about 50 percent extra carbon dioxide, showing extra photosynthesis and more-efficient water use.

These vines produced the same concentration of the toxic oil urushiol as the plain-air vines did. However, for the poison ivy receiving extra carbon dioxide, about 20 percent of the oil was in chemically unsaturated forms, whereas the plain-air ivy produced 15 percent unsaturated urushiol. The unsaturated forms are more likely to provoke painful skin reactions in people.

Other studies have suggested that vines may be big winners in a high–carbon dioxide future, says Mohan. Vines don't spend much of their carbon harvest on trunks or other supports, so the carbon windfall can go directly into new leaves, which collect yet more carbon and sunlight.

An increased abundance of vines, which can choke out trees, could change forest dynamics, Mohan says.

Forest honeysuckle vines increase their growth in air that's high in carbon dioxide, says Rich Norby, who directs a pipe-circle experiment at Oak Ridge (Tenn.) National Laboratory. However, he predicts that even poison ivy's gangbuster growth will eventually hit some limit, such as available sunlight.

The pipe-circle experiments can't mimic all the factors influencing plants in real forests. Mohan protected her experimental poison ivy plants from white-tailed deer and other browsing animals, notes plant physiologist Hendrik Poorter of Utrecht University in the Netherlands. Yet plants growing in abundant carbon dioxide typically have low protein content, so Poorter speculates that animals might actually eat more of them to get adequate nutrition.

Bigger, more-toxic poison ivy is a serious concern, says Paul Beggs of Macquarie University in Australia. It's another factor to add to his tally of the extra misery that climate change might bring to people with allergies. For example, certain pollen counts are likely to go up, so allergy seasons could drag on longer, he says.

Mohan had never developed a rash from poison ivy before she started the study. "I get it now," she says. —S. MILIUS

# Herpes Runs Interference

## Researchers discover how virus sticks around

**Herpes simplex virus 1 (HSV-1), which** causes cold sores, uses a short, double-stranded RNA to outwit a cell's defensive measures. That's why it can hang out in the body indefinitely, new research suggests. By disrupting this mechanism, scientists may eventually find a way to permanently eradicate herpes infections in people.

Both HSV-1 and its close relative HSV-2, which typically causes genital herpes, infect the nerve cells located outside the brain and spinal cord. Once a person becomes infected, HSV-1 and HSV-2 stick around in a dormant state and can intermittently cause breakouts in some people. The virus succeeds in its long-term residency because it prevents immune system prompts that usually lead virus-infected cells to sacrifice themselves, says microbiologist Nigel Fraser of the University of Pennsylvania School of Medicine in Philadelphia.

Six years ago, a Los Angeles–based team of researchers discovered a viral gene that they named the latency-associated tran-

script gene (*LAT*). This gene seemed to control HSV-1's capacity to lay low. However, after years of searching, scientists hadn't located any *LAT*-encoded protein, which would offer clues to how the gene exerts its life-sustaining effect on cells.

Traditionally, scientists determine what protein a gene encodes by searching for the often-lengthy RNA transcript, which translates the gene's information into its product. "People had been looking for these long [*LAT*] RNAs," says Fraser.

However, some researchers took a different approach. They hypothesized that instead of a protein, *LAT*'s product is a microRNA—a tiny, double-stranded piece of RNA that a cell's enzymes cut from a longer transcript. Recent research has suggested that cells and some pathogens use microRNAs to control a variety of cellular processes.

To investigate this hunch, Fraser's team worked with lab-grown cells. In some of the cells, they shut off production of the dicer enzyme, which processes long strands of RNA into microRNAs. They then slipped *LAT* into all the cells.

When the scientists doused the cells with a chemical that triggers cell suicide, those without the dicer enzyme died. Cells with dicer survived the chemical onslaught, suggesting that dicer processes the microRNA that gives the cells their staying power.

Next, the researchers used a computer program to scan *LAT* for sections that have sequences characteristic of microRNAs. The team inserted its leading-candidate microRNA into cells and then added the suicide-inducing chemical. Their small RNA snippet kept the cells alive, says Fraser.

In previous studies, researchers have shown that a small, double-stranded piece of RNA can sometimes muffle the effects of a gene that has a complementary sequence. This phenomenon is known as RNA interference *(SN: 7/2/05, p. 7)*. To determine which gene or genes the *LAT* microRNA might be acting on, Fraser's team used another computer program to search for complementary DNA segments.

They found that the microRNA matched up with parts of two genes called *TGF-beta* and *SMAD3*. These genes were already known to control cell suicide. The *LAT* microRNA silenced the effects of these two genes, Fraser's team reports in an upcoming *Nature*.

"This is an exciting study that ... provides a plausible mechanism for [herpes] latency," says microRNA researcher Victor R. Ambros of Dartmouth Medical School in Hanover, N.H. He adds that the newly identified *LAT* microRNA might have evolved to take advantage of some normal, but currently unknown cellular process directed by microRNA.

Further information about how the *LAT* microRNA operates in cells could direct scientists as they craft herpes-fighting drugs, says Fraser. "This could be the first chink into the armor of the virus," he adds. —C. BROWNLEE

## Lazarus, the amphibian

**Missing for more than a decade and feared to be extinct, a painted frog has resurfaced. At least one population of the subspecies *Atelopus ebenoides marinkellei* remains in a remote desert highland of Colombia, researchers discovered last month. In an amphibian-biodiversity survey, team leader Carlos A. Rocha of the Pedagogical and Technological University of Colombia in Boyacá found the 3-to-9-centimeter-long frogs in the same locale where they were last spotted in 1995. Like many amphibians worldwide, the species has been devastated in recent decades by the fungal skin disease chytridiomycosis. "The finding must motivate us to adopt urgent measures toward saving the last of these amphibians," says Fabio Arjona, executive director of Conservation International in Colombia, which supported Rocha's research.** —B. HARDER

# Wrong Impression

## Bipolar kids misinterpret facial cues as hostile

**Children with bipolar disorder are more** likely than other kids to read hostility in bland facial expressions, a new study shows. Misinterpreting social cues might contribute to irritability and the unprovoked aggression that bipolar children sometimes direct toward others, the researchers say.

While the children were misconstruing facial cues, excessive activity arose in brain areas that are associated with emotion processing, magnetic resonance imaging (MRI) revealed. The study is the first to combine tests of facial interpretation and simultaneous MRI measurements in brain regions pivotal to bipolar disorder in children, says study coauthor Ellen Leibenluft, a psychiatrist at the National Institute of Mental Health (NIMH) in Bethesda, Md.

The researchers compared 22 bipolar children with 21 mentally healthy children. Both groups averaged 14 years of age. Eighteen of the bipolar children were taking some form of psychiatric medication.

The participants viewed pictures of people's faces and answered questions about the hostility of each face. The faces were standard representations of anger, fear, happiness, and a neutral mood. The bipolar children rated the first three categories on a par with the other children but read more hostility into the neutral faces than did the others, the researchers report in the June 6 *Proceedings of the National Academy of Sciences*.

MRI scans of the bipolar children as they rated the neutral face showed revved-up activity in brain regions known to process emotions, particularly in an area called the amygdala, says study coauthor Brendan A. Rich, a child psychologist at NIMH.

Previous research had indicated that bipolar children tend to have smaller amygdalas than other children do, says psychiatrist Melissa P. DelBello of the University of Cincinnati. The new research also suggests that the amygdala functions differently in bipolar children, she says.

It's unclear why the amygdala would work overtime while bipolar children read faces, Leibenluft says. It could be because it's undersized or because it communicates poorly with other emotion-processing brain regions, she says.

ROCHA

Because they don't know the cause of bipolar disorder—formerly known as manic depression—scientists can't tell whether difficulties in processing facial cues contribute to manic and depressed states, or whether those mental states hamper the processing of facial cues, Leibenluft says.

At the time of the examination, one-fourth of the bipolar children were slightly manic, one-fourth were mildly depressed, and the rest were neither. Rich notes that facial misconceptions spanned all the bipolar children, regardless of mood.

In daily life, failure to accurately discern intent from facial cues causes problems for bipolar children, DelBello says. "They get irritable with people whom they shouldn't get irritated at. Then, they become hostile and explosive," he notes.

"Social skills depend on the ability to rapidly infer meaning from facial expression," Rich says. Children who are slow to do that, or who misconstrue the signals sent to them, may react inappropriately and put off others, he says.

In her practice, DelBello sees evidence that bipolar children also miss some cues altogether. "There are kids who are very disruptive in the classroom," she says. "They can't put the brakes on because they can't read that the teacher is upset."

By paying attention to this inability to grasp facial signals, therapists might diagnose bipolar disorder earlier and teach children to better recognize cues to other people's emotions, Leibenluft says. —N. SEPPA

# Oil Booms

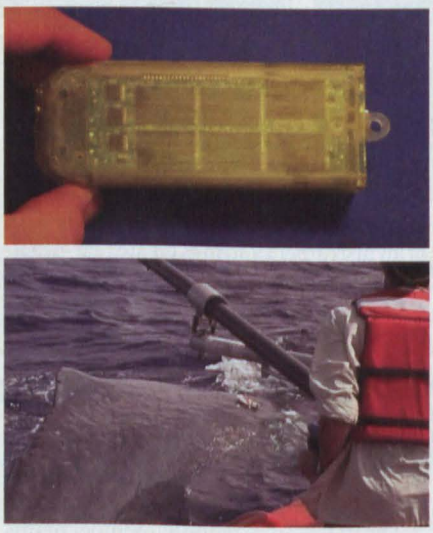
## Whales don't avoid noise of seismic exploration

**Field tests in the Gulf of Mexico suggest** that sperm whales there don't swim away from boats conducting seismic surveys of the seafloor. However, the surveys' noise—typically generated during the hunt for oil and natural gas deposits—may be having subtle effects on the whales' feeding behavior.

Scientists use a device called an air gun to probe the seafloor. A burst of compressed air at the ocean's surface creates intense pressure pulses that travel through the water. The intensity and timing of the echoes from the ocean bottom provide information about buried geological structures. Biologists have been concerned that such pulses may damage a whale's hearing or mask the clicks that whales make to home in on food, says Patrick J. Miller, a marine biologist at the University of St. Andrews in Scotland.

To investigate the effects of seismic surveys, Miller and his colleagues tagged eight whales with devices that recorded each animal's depth, orientation in the water, movements, and the sounds that it heard or made. The devices, held on by suction cups, recorded information about each whale for an hour or so before and during nearby seismic surveys.

For most of the tagged whales, diving patterns didn't change after seismic surveys began, Miller reported last week in Baltimore at the spring meeting of the American Geophysical Union. Even when air gun–firing boats passed as close as 1 kilometer, the animals didn't substantially change the direction in which they were swimming. This observation hints that the animals aren't directly harmed by the seismic activity, says Miller.



**WHALE OF A RECORDER** Using a device designed to monitor a whale's movements (top image), scientists tagged sperm whales in the Gulf of Mexico (bottom) to study their behavior during noisy seismic surveys.

However, tagged whales expended a little less energy searching for food and emitted fewer clicks associated with homing in on prey during the seismic surveys than they had before those surveys commenced, says Miller. Although those differences aren't statistically significant, perhaps because of the small number of whales studied, Miller says that such changes in behavior could reduce the animals' food gathering during seismic surveys. He explains that funding isn't available to continue the work using more whales.

Aquatic creatures may not be as disturbed by noise from seismic tests as people have presumed, says Penny Barton, a marine geophysicist at the University of Cambridge in England. During a seismic survey last year off the coast of Mexico's Yucatán peninsula, she and her colleagues placed a video camera on the seafloor in 20-meter-deep water to observe the fish there. Even though a vessel with its air guns blasting passed within 180 m of the camera, fish didn't change their behavior, she says.

The effort expended to mitigate the effects of seismic surveys on marine life can drastically reduce the effectiveness of scientific expeditions, says Barton. During last year's expedition, her team interrupted data collection 14 times to avoid exposing dolphins and sea turtles to potentially damaging levels of submarine sound. Furthermore, because the researchers had to visually confirm that animals remained at a safe distance, they couldn't fire air guns at night or when waves were high. In all, they collected only about 40 percent of the data that they could have otherwise, she reported at the meeting in Baltimore. —S. PERKINS

# Stones of Contention

## Tiny *Homo* species tied to ancient tool tradition

**New discoveries have shifted a prehistoric,** island controversy from bones to stones. Simple stone tools accompanied the fossils of *Homo floresiensis*, the half-size human cousin that inhabited the Indonesian island of Flores around 74,000 to 12,000 years ago, but some scientists argued that those tools had been made by *Homo sapiens*. Now, much older tools discovered on Flores suggest that *H. floresiensis* individuals carried on cultural practices initiated by their island ancestors.

Stone artifacts much like those previously found among *H. floresiensis* fossils in Flores' Liang Bua cave have emerged at another site on the island. The new finds date to between 840,000 and 700,000 years ago, reports a team led by Adam Brumm of the Australian National University in Canberra.

Ancient hominid settlers of the island—either large-bodied *Homo erectus* or a smaller species in our evolutionary family—lived at that site, called Mata Menge, and passed on their toolmaking techniques to later generations, the scientists propose. Eventually, when the small-brained *H. floresiensis* evolved, the species retained many of the tool-production practices from its forebears, Brumm and his coworkers conclude in the June 1 *Nature*.

"On Flores, we see continuity of a rather specific package of stone-toolmaking behaviors, including the manufacturing of distinctive tools that do not appear elsewhere in southeastern Asia," Brumm says.

The latest Flores finds show that the diminutive islanders, with their craniums the size of chimps', possessed enough brainpower to parlay cultural traditions into effective toolmaking. Until now, debate about the small Flores creatures centered on suspicions that such tools could only come from modern humans, who in this

case had experienced stunted growth (*SN: 10/15/05, p. 244*).

Mata Menge lies 50 kilometers east of the Liang Bua cave. Mata Menge excavations in 2004 and 2005 yielded 487 stone artifacts. Another 20 stone implements had been unearthed at the same spot in 1994. All the finds lay in soil sandwiched by volcanic ash layers, which the researchers dated.

The same type of rock and comparable toolmaking techniques characterize the 3,626 Liang Bua artifacts that have been excavated, Brumm's group asserts.

Archaeologists regard the new Flores discoveries cautiously, and in some cases with deep skepticism.

It's hard to know whether a single Stone Age culture connected residents of Mata Menge to Liang Bua's inhabitants or whether separate hominid populations happened to exploit similar, basic toolmaking techniques, remarks Dietrich Stout of University College London. For now, Stout attributes the Liang Bua tools to *H. floresiensis* "until a better candidate comes along."

The new finds leave unresolved the identity of the Flores toolmakers, asserts John Shea of the State University of New York at Stony Brook. "I don't think we can rule out *Homo sapiens* as the [maker] of the Liang Bua tools," he says.

*H. sapiens* had spread through much of Indonesia by around 50,000 years ago and made stone tools similar to those found on Flores, Shea notes. The tools from Mata Menge and Liang Bua are too simple to demonstrate a cultural connection, in his view.

James L. Phillips of the Field Museum in Chicago calls the new report's conclusions "beyond belief." Mata Menge artifacts lay in unstable river sediment that moved over time, making it impossible to obtain accurate age estimates, Phillips holds.

He suspects that *H. sapiens* made both the Mata Menge and Liang Bua tools no more than 18,000 years ago. —B. BOWER

**ROCK ISLAND LINE** Stone artifacts from Mata Menge (top) and Liang Bua (bottom) represent a longstanding Stone Age culture that benefited tiny inhabitants of an Indonesian island, a research team argues.

# String Trio

## Novel instrument strums like guitar, rings like bell

**At the heart of many of the world's musi**cal instruments is the same, simple component—a string stretched tight between two points. Plucked, bowed, or struck, each of an instrument's strings creates ear-catching vibrations.

Now, mathematicians in Canada say that they have invented a family of music-making devices based on a network of three or more string segments—for instance, a Y-shaped string anchored at three endpoints. The extra segments supply exotic overtones that a single string doesn't, say the researchers.

The first, and so far only, member of this new family of instruments is the tritare—rhymes with guitar—devised by mathematicians Samuel Gaudet and Claude Gauthier of the University of Moncton in New Brunswick. Resembling a guitar with two extra necks, the tritare hosts six Y-shaped strings. As in an ordinary guitar, each tritare string runs from a tuning peg along a fretted neck. However, the familiarity ends at an unanchored juncture point where the string branches. From there, one string segment runs along each of the two extra, unfretted necks.

Gaudet notes that a conventional, two-anchor musical-instrument string generates a fundamental sound frequency plus harmonics. Those frequencies are two, three, or other-integer multiples of the fundamental frequency.

The tritare generates not only those harmonic overtones but also nonharmonic ones, he says. Listeners typically hear such nonharmonic overtones from percussion instruments—for instance, bells or gongs—which vibrate in more-complicated patterns than simple strings do.

Depending on how each note on a tritare is played, the sound can include a few or many nonharmonic ingredients, Gaudet says. So, he adds, the instrument offers "a richer sound than does a classical stringed instrument."

**Y NOT?** The tritare, a new type of musical instrument, uses three string segments that form a Y shape (top inset). The instrument's inventors are exploring sounds generated by other string networks as well (bottom inset).

M. MOORE; GAUDET

Richer yes, but not necessarily better, comments physicist and acoustics specialist Bernard Richardson of Cardiff University in Wales. "The branched string is really a simple analogue of the more complex structures found in things like plates and curved shells—bars, cymbals, bells, and gongs," he notes. However, "to my ears [the tritare] just sounded like a badly out-of-tune instrument."

"Sounds which are richer and less safe harmonically ... provide inspiration and ways to musically express different things," Gaudet contends. He and his colleague Sophie Léger, also of the University of Moncton, are slated to discuss the tritare and its design principles this week at a meeting of the Acoustical Society of America in Providence, R.I. Online sound clips of the tritare are available at *http://www.acoustics.org/press/151st/Leger.html*.

Given that so much music experimentation these days is done with computers, "the tritare may be one of the last new instruments to be invented relying entirely on novel physics without incorporating any computational element," comments physicist and experimental-musical-instrument maker Benjamin W. Vigoda of the Massachusetts Institute of Technology. —P. WEISS

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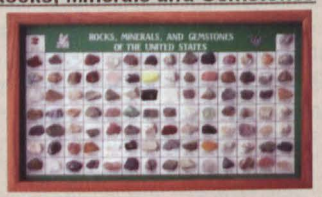


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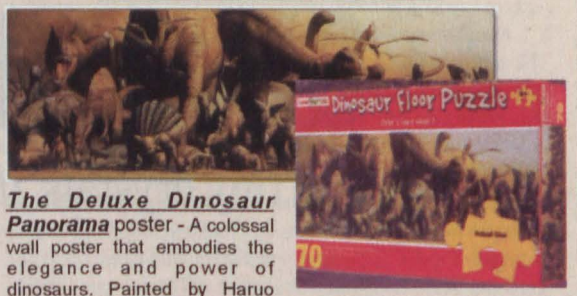


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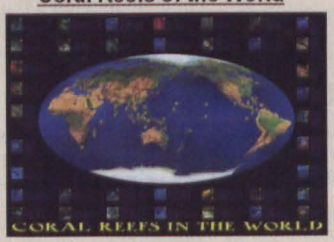


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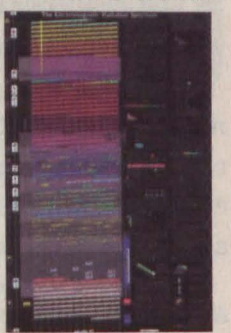

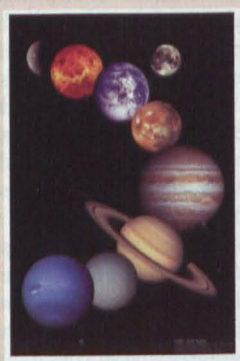

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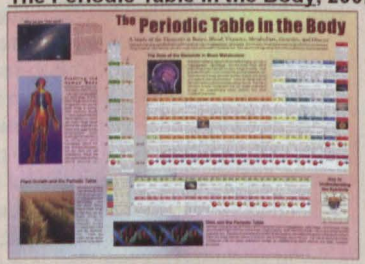


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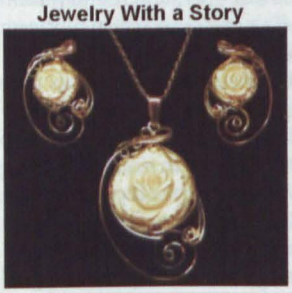

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# QUANTUM-DOT LEAP

## Tapping tiny crystals' inexplicable light-harvesting talent

BY PETER WEISS

One frustration of solar energy is that although it's free, clean, and inexhaustible, it's a major challenge to harvest efficiently. Consider what happens when photons of sunlight hit a solar cell: They strike electrons in semiconductor material and send them on their way as an electric current. Although many solar photons carry enough energy to theoretically unleash several electrons, they almost never free more than one.

The complex physics behind that limitation boils down to this: An electron loosed by absorbing a photon often collides with a nearby atom. But when it does, it's less likely to set another electron free than it is to create atomic vibrations that squander the electron's excess energy on heat.

For the past half century, the limit of one electron per solar photon seemed a regrettable fact of semiconductor physics. However, in recent tests of semiconductor bits only a few nanometers in diameter—entities known as nanocrystals or quantum dots—researchers have been surprised to find that photons at solar energies commonly unleash multiple electrons.

The number set loose depends on the dot's composition and—as a quirk of quantum mechanics—its size. Recent experiments on 8-nanometer-diameter lead selenide quantum dots have given the best results so far: Ultraviolet-light photons—albeit at a wavelength found sparingly in sunlight—released seven electrons apiece.

That leap in producing electrons could lead to major improvements in solar cell efficiencies, the researchers say, that is, if those electrons can be harvested from the cells. So far, evidence from prototype solar cells and photodetectors suggests that the newfound effect can indeed improve cells' power outputs.

"It's not just a pipedream to think about this [multiplication effect] giving you a real benefit in a solar cell device," says Richard D. Schaller of Los Alamos (N.M.) National Laboratory. Other technologies that might benefit include lasers that operate at useful wavelengths not attainable with other materials and solar water splitters that produce hydrogen for fuel cells (*SN: 10/30/04, p. 282*).

Whereas the new effect's practical potential is apparent, the means by which solar photons yield so many electrons is not. In a heated debate, some scientists argue that a previously unseen type of quantum mechanical entity must briefly form in each quantum dot. Others contend that an already well-understood process can account for the multiple-electron output.

"What's exciting here is this unexpected result," says Arthur J. Nozik of the National Renewable Energy Laboratory (NREL) in Golden, Colo. "This is very interesting new physics."

**SIZE MATTERS** In the electrical realm, semiconductors occupy a middle ground between insulators and conductors. Whereas atoms of insulators bind their electrons tightly, conductor atoms let those negatively charged particles roam free. In contrast, semiconductor atoms hold their electrons until given small energy boosts. Then, the electrons are available to flow as current.

If a photon strikes an electron in a semiconductor with more than the threshold amount of oomph, called the material's band-gap energy, the electron breaks loose. It leaves behind a vacancy, known as a hole, in the atom's electronic structure. Each free electron–hole pair created by a photon is called an exciton.

Despite the one-photon-one-exciton rule that solar-energy specialists had observed when photons hit the semiconductors in their power cells, physicists had known since the 1950s that photons at much higher energies could give rise to multiple excitons. They had observed, for instance, that X-ray photons trigger swarms of excitons in semiconductor materials.

Scientists also determined that such multiple-exciton production takes place by means of a process called impact ionization. Roughly speaking, an electron from an exciton strikes an electron bound to an atom, creating another exciton. If enough excess energy remains in the newly formed exciton, its electron can create yet another exciton, and so on. However, at the relatively low energies of solar photons, subtleties related to electron motion largely prevent the exciton-to-electron energy transfers, so only negligible impact ionization occurs, Nozik notes.

> "It's not just a pipedream to think about this giving you a real benefit in a solar cell device."
>
> — RICHARD D. SCHALLER, LOS ALAMOS NATIONAL LABORATORY

Quantum dots, which were first made in the 1970s, introduce another factor: size. Until the dots' debut, researchers knew what happened only when light struck larger pieces of semiconductor, such as those in a transistor or microchip.

The wavelike nature of electrons, as dictated by quantum mechanics, makes itself felt at the dot's minuscule dimensions. For instance, a dot has a larger band-gap energy than does the same semiconductor material in bulk, so the dot absorbs higher-energy, bluer light. Also, because a dot is often as small in diameter as the wavelength of an electron inside it, the dot immobilizes the electron.

About a decade ago, Nozik began to suspect that the smallness of quantum dots might make impact ionization a fruitful process at solar-radiation energies. For example, he figured that a dot's grip on an electron would nullify the motion-related subtleties that squelched the process at larger scales. So, he and his team set out to find an exciton boost in quantum dots of indium phosphide and indium arsenide.

**SEVEN UP** As it turns out, Nozik's crew was focused on the wrong quantum dots. At Los Alamos, however, Schaller and Victor I. Klimov had begun studying lead selenide nanocrystals as potential components in lasers.

When those researchers looked at the effect of high-energy blue

light, they saw the first evidence of solar-energy photons creating more than one exciton apiece. In a 2004 report, the Los Alamos physicists reported that photons could generate as many as three excitons apiece in lead selenide quantum dots (*SN: 4/24/04, p. 259*).

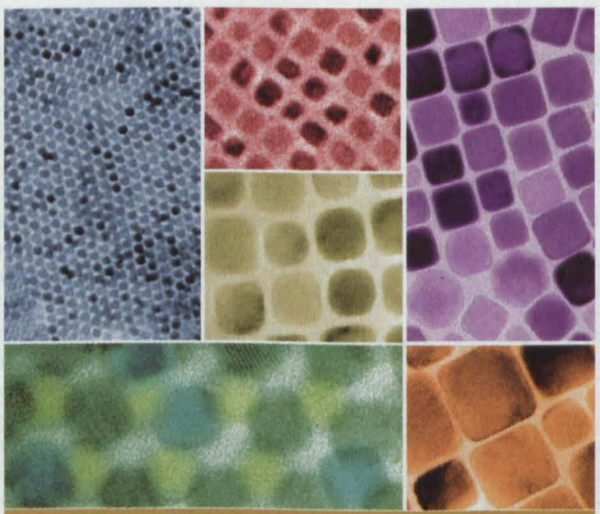
Shifting gears, Nozik, NREL's Randy J. Ellingson, and their colleagues verified the Los Alamos findings about a year later. They also unveiled the first evidence for multiple excitons from another type of quantum dot, made of lead sulfide.

Curious whether the effect was peculiar to lead-based quantum dots, the Los Alamos researchers tested a quantum dot with a very different electronic structure. In the Dec. 19, 2005 *Applied Physics Letters*, they reported signs that cadmium selenide dots were producing two excitons apiece.

"The fact that they can see [multiple excitons] in that material suggests that maybe it happens in all quantum dots," comments physical chemist Philippe Guyot-Sionnest of the University of Chicago.

Extending their work on lead-based dots, the NREL researchers report in the March 15 *Journal of the American Chemical Society* that lead telluride dots produce up to three excitons from single solar-energy photons. Currently, the Los Alamos researchers are examining cadmium telluride nanocrystals.

In further studies of lead selenide dots reported in the March *Nano Letters*, the Los Alamos group has evidence that some ultraviolet-light photons can trigger seven excitons apiece. Even bigger hauls are likely, the team asserts.



**PAVED WITH LEAD** — Electron micrographs reveal arrays, shown in false color, of spherical and cubic quantum dots made of lead selenide and lead telluride.

Hypothetically, the number of excitons a photon creates corresponds to the energy of the photon divided by the dot's band-gap energy. That's because the photon must deliver one band-gap's worth of energy to each electron that it breaks free from an atom. Using a dot with a smaller band gap increases the expected number of excitons because less energy is needed to push each electron over the threshold, Klimov explains.

In practice, however, effects such as the distribution of photon energy between electrons and holes require that photons have more than the hypothetically required energy to produce a specific number of excitons. For instance, the NREL team finds that in lead selenide dots, a photon must have at least two and a half band gaps of energy to produce two excitons. Tests at Los Alamos indicate a minimum requirement of three band gaps.

Regardless of exactly how much photon energy is needed, even the most modest boost in solar cells—say, to two excitons per photon—"would be a major, major achievement," Nozik says.

**QUICK QUESTION** The mounting evidence for the quantum-dot effect has sparked debate. The dispute centers on this question: Can impact ionization account for what's going on or is there something at play that was previously unknown and thus more exciting? "Right now, there's a lot of fighting in the area of theory," notes Klimov.

In Klimov's tests and the NREL experiments, the process seems instantaneous because the multiple excitons appear so quickly—within less than 50 femtoseconds (fs), or thousandths of a trillionth of a second. However, impact ionization proceeds sequentially. That is, after a photon creates the first exciton, that exciton creates the second exciton, which in turn generates the third, and so on. Could that step-by-step process create seven excitons in less than 50 fs?

Theorist Alexander L. Efros of the Naval Research Laboratory in Washington, D.C., thinks not. In collaboration with Nozik's team, Efros has invoked quantum theory to propose that a photon hitting a quantum dot instantaneously creates a novel quantum object that's simultaneously both one and many excitons.

In a slightly less exotic interpretation, theorist Vladimir M. Agranovich of the Russian Academy of Sciences in Moscow, collaborating with Klimov and Schaller, suggests that a so-called virtual exciton springs into existence for a moment after the photon hits. Armed briefly with more energy than physics ordinarily permits, it spawns the multiple excitons simultaneously—a scenario that the physicists described in the December 2005 *Nature Physics*.

Disagreeing with such extraordinary scenarios, Alex Zunger, a theorist at NREL, says that his team's calculations indicate that impact ionization can account for the experimental findings.

Maybe yes, maybe no, says theorist Guy Allan of the Institute of Electronics, Microelectronics, and Nanotechnology in Lille, France. Creation of a new exciton takes a mere 0.1 fs, so 50 fs is plenty of time to make seven or more excitons, he says.

Yet he adds that calculations by him and his institute colleague Christophe Delerue account for a few excitons per photon from impact ionization, but not as many as the maximum observed in quantum dots. Says Allan, "There may be another process to discover."

**GOING DOTTY** If the mysterious multiple-exciton effect pans out in practical devices, solar cell efficiencies could soar, scientists say. Both the Los Alamos and NREL teams calculate a maximum of 42 percent conversion of solar power to usable electricity. Conventional cells, by contrast, operate at 15 to 20 percent efficiency.

Some researchers have made prototype photodetectors and solar cells from quantum dots. For instance, Difei Qi of Louisiana Tech University in Ruston and her colleagues mixed a conductive, photosensitive polymer known as MEH-PPV with lead selenide quantum dots. Under visible light, a device incorporating dots at only about 5 percent by weight generated 50 percent more current than expected if each photon yielded one exciton, the Louisiana team reported in the Feb. 28, 2005 *Applied Physics Letters*.

More recently, a Texas team working with Klimov and Schaller made experimental solar cells by blending 8-nm-diameter lead selenide quantum dots with another conductive polymer called polythiophene. "We see a dramatic increase in photocurrent at exactly three multiples of the band-gap energy," says Anvar A. Zakhidov of the University of Texas at Dallas in Richardson. That current ramp-up indicates that photons are producing multiple excitons, he reported last March in Baltimore at a meeting of the American Physical Society.

Despite such encouraging signs, before highly efficient solar cells appear, "there's a lot of work to be done," Nozik cautions.

Generating extra excitons might also have a major impact on equipment that uses solar energy to split water to extract its hydrogen for various uses—for instance, to energize fuel cells—Klimov says. Each water-splitting reaction requires four electrons, he notes, so the more electrons per solar photon the better.

Scientists have used quantum dots to make laser beams of wavelengths not available with natural dyes or crystals. The boost in exciton productivity could also make such lasers more efficient.

Efficiency could become a hallmark of many quantum-dot technologies. As oil prices soar to record levels, thrifty quantum dots promise to give solar energy in particular an even more powerful appeal. ■

# BLOOD, IRON, AND GRAY HAIR

## Anemia in old age is a rising concern

BY BEN HARDER

The life of a red blood cell is brief but fast paced. Each heartbeat pumps millions of the tiny cells into the body's vascular system at speeds of more than a meter per second. In about a minute, they can carry oxygen from the lungs to tissues in the rest of the body and return to the lungs. And they die before they're 4 months old. The body replaces old red blood cells by generating fresh ones, typically producing about 2 million cells per second.

For a variety of reasons, however, the production of new red cells can fall behind the loss of old ones.

The resulting deficiency, called anemia, turns up among people of all ages, but recent research shows that it disproportionately affects seniors. One study estimates that after age 85, 26 percent of men and 20 percent of women are anemic. And while symptoms in young and old people alike include fatigue, headache, and pale skin, the new findings link anemia in elderly people to additional effects, including accelerated physical and mental decline and a shorter life span.

Far from being an innocuous part of old age, anemia may reflect a serious health problem, recent studies show.

"If you're anemic [and elderly], you won't live as long as a person who's not anemic," says hematologist Jerry L. Spivak of Johns Hopkins University in Baltimore.

"[Anemia] is associated with higher mortality, disability, higher risk of falls in the elderly, poorer quality of life, increased hospitalization risk, and increased health care utilization," says geriatrician and epidemiologist Luigi Ferrucci of the National Institute on Aging (NIA) in Baltimore.

Furthermore, in about one-third of anemia cases among elderly people, no obvious cause can be found. That makes treating anemia difficult, if not impossible.

Researchers have begun to investigate the causes of anemia in the elderly population and to explore possible treatments. So far, they have more questions than answers. But one early result suggests that injections of the hormone erythropoietin may relieve anemia's consequences in relatively healthy elderly people. If further trials bear out that finding, a vast number of senior citizens could have reason to seek the treatment.

**PREVALENT PROBLEM** Premenopausal women are much more likely to be anemic than are their male peers. About 12 percent of U.S. women between the ages 17 and 49 have anemia, while barely 1 percent of similarly aged men do, according to national data.

The study that yielded those figures, the National Health and Nutrition Examination Survey (NHANES), employed a widely used definition of anemia that the World Health Organization (WHO) developed decades ago. Anemia is typically measured in terms of blood concentration of hemoglobin, the red blood cell molecule that binds to oxygen in the lungs and releases it where it's needed. According to WHO, a man is anemic if he has a hemoglobin concentration lower than 13.0 grams per deciliter (dl), whereas a cutoff of 12.0 g/dl applies to women.

By comparison, average hemoglobin concentrations exceed 15.0 g/dl and 13.5 g/dl in non-elderly white men and white women, respectively. Average concentrations for black men and women are slightly lower than those for whites.

In contrast to the pattern seen in younger adults, "older men tend to have lower hemoglobin than older women," says geriatrician Claudia Beghé of the James A. Haley VA Medical Center in Tampa, Fla.

Two years ago, an analysis of the NHANES data found that 10 percent of women between 75 and 84 years old—and 16 percent of men in that age range—are anemic. In people 85 or older, each gender faced a 10 percent greater risk, Ferrucci and his colleagues reported in the Oct. 15, 2004 *Blood*. That research excluded people who were hospitalized or living in nursing homes.

In segments of the elderly population, anemia is even more prevalent than that. Beghé and two colleagues reviewed 71 studies in 2004, including the *Blood* study and some studies that examined only hospital patients or nursing home residents. They found that among people in some medical wards as many as 61 percent are anemic.

> Anemia in the elderly "is associated with higher mortality [and] poorer quality of life."
>
> — LUIGI FERRUCCI, NATIONAL INSTITUTE ON AGING

Overall, among those over age 65, "anemia is affecting 3 million people in the United States," says Ferrucci.

**PATTERN OF RISK** For the senior population, anemia is not a benign condition. In one research effort, for example, geriatrician Harvey Jay Cohen of Duke University Medical Center and the VA Medical Center in Durham, N.C., and his colleagues tested blood-hemoglobin concentrations in 1,744 North Carolina residents who were at least 71 years old. By the WHO criteria, 24 percent of the volunteers were anemic when the study began.

At the study's outset in 1992 and again in 1996, the researchers assessed each volunteer's cognitive and physical status, including his or her memory and handling of life's daily activities.

"People with anemia had lower physical function and lower cognitive status," Cohen says. They were also more likely than the others to deteriorate during the 4-year interval. "Having anemia predicted further declines in physical function and cognitive status," Cohen says.

Furthermore, participants who had anemia in 1992 were 70 percent more likely than the others to have died by 2000, Cohen's team reports in the April *American Journal of Medicine*.

Some fraction of the anemia-associated deaths can be blamed on factors other than the low hemoglobin concentration that was disproportionately common among those with anemia. But even

after taking into account obesity and other background differences, Cohen's team found that anemia was associated with a 40 percent increase in death rate.

Over a 4-year period, Brenda Penninx of Wake Forest University in Winston-Salem, N.C., and her colleagues, including Ferrucci, found that people over 70 who initially had anemia were 20 percent more likely to be hospitalized and about 75 percent more likely to die than were initially nonanemic participants (*SN: 1/10/04, p. 30*).

Penninx and her colleagues have also found that elderly people with anemia lose more muscle strength over a 4-year period than do people who don't have anemia.

In another recent study, hematologist Mary Cushman of the University of Vermont College of Medicine in Burlington and her colleagues measured hemoglobin in men and women age 65 or older who were well enough to be living at home. Of nearly 5,800 volunteers, 8.5 percent were anemic by WHO criteria when the study began.

The volunteers remained in the study for 11.2 years on average. By 2001, 2,350 of them had died. Deaths were least frequent in people with moderately high hemoglobin concentrations—about 14 g/dl in women and slightly more than 15 g/dl in men.

Compared with those people, volunteers who were anemic but otherwise of similar health at the outset were 38 percent more likely to die during the study, the researchers reported in the Oct. 24, 2005 *Archives of Internal Medicine*.

Death rates were also elevated among people who were not anemic by WHO criteria but who had low-normal hemoglobin concentrations, Cushman's team found. Penninx and other researchers have made similar observations, which cast doubt on the clinical relevance of the WHO criteria's cutoff for defining anemia.

Physicians should seek to diagnose anemia and, when possible, reverse it in their elderly patients, Cushman says. However, she cautions that the data don't prove that anemia contributes to mortality risk. Some underlying factor might both cause the anemia and shorten lifespan.

Anemia weighs particularly heavily on blacks, several studies show. That's true among elderly people as well as other age groups. "Anemia in the old is threefold more common in blacks than in whites," Cohen says. In his study, elderly people with anemia had similar rates of death, regardless of their race.

**SEEKING CAUSE** Anemia occurs when the body produces insufficient amounts of hemoglobin. Sometimes, the cause is a shortage of iron, the metal in hemoglobin that permits the molecule to bind and release oxygen.

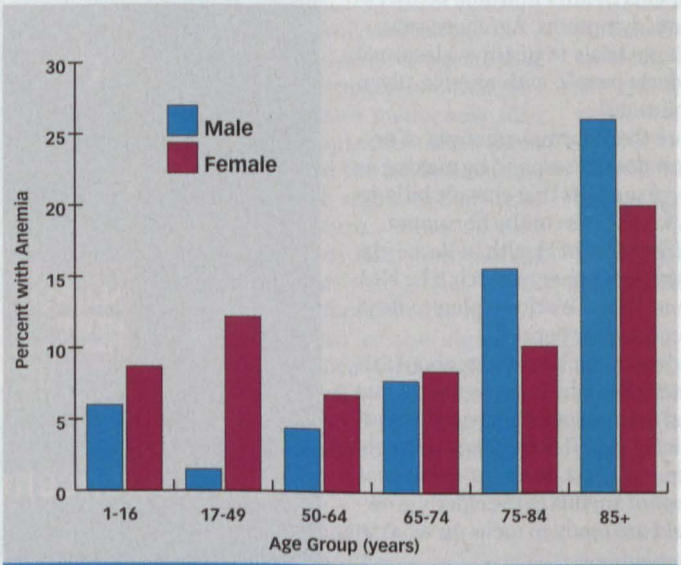
In children, common causes of anemia are inadequate iron intake and genetic diseases. In women of childbearing age, loss of menstrual blood can remove iron more quickly than it can be replaced. Bleeding robs the body of iron that otherwise would get recycled into the next generation of red cells.

"Correction of the underlying disorder is the most effective means of alleviating the anemia," says Spivak.

A test called a complete blood count identifies anemia and sometimes hints at its cause. Roughly one-third of anemia cases in elderly people are caused by deficiencies of iron or of vitamin $B_{12}$ and folic acid, which the body needs in order to make red blood cells. These deficiencies can often be corrected by dietary changes or inexpensive treatments, Ferrucci says.

Another one-third of elderly cases, he says, are related to underlying chronic diseases that lead to inadequate utilization, rather than deficient intake, of iron.

Specific causes of poor iron utilization include various cancers and chronic kidney disease, which results from advanced diabetes. Many scientists are focusing on the role of inflammation, such as that seen in rheumatoid arthritis and during chronic infections, in causing the anemia associated with chronic disease.




**A MATTER OF AGE** — Anemia becomes increasingly prevalent in both sexes after age 65, according to data from the National Health and Nutrition Examination Survey. Anemia is also frequent in younger women because of blood loss during menstruation.

Some of these conditions are an aftermath of the aging process and defy correction, says Spivak.

Diabetes, chronic kidney disease, and chemotherapy all seem to impair the kidneys' production of erythropoietin, a hormone that's essential for red-cell production. Synthetic erythropoietin can boost the body's manufacture of red blood cells and ameliorate symptoms of anemia in people who have severe kidney disease or who are undergoing chemotherapy. Trials have demonstrated that injecting epoetin alfa, a form of erythropoietin, improves brain function and quality of life in these people.

Even with thorough diagnostic testing, the underlying problem is unclear in about a third of elderly people with anemia, Ferrucci says. Some recent data suggest that, as a group, elderly people whose anemia can't be explained tend to have mild kidney dysfunction and impaired production of erythropoietin. That raises the possibility that erythropoietin therapy could be useful in that large group of currently untreatable people.

**TEST TREATMENT** No published trial has tested whether synthetic erythropoietin works against unexplained anemia or anemia caused by a variety of chronic ailments, says geriatrician Parag Agnihotri of Michael Reese Hospital in Chicago. Two years ago, he and his colleagues set out to determine whether epoetin alfa could improve quality of life in patients who were at least 65 years old and had chronic anemia.

For 16 weeks, they gave Procrit, a brand of epoetin alfa, in a weekly injection to 58 volunteers who had less than 11.5 g/dl blood hemoglobin. Either before or after that treatment, they gave the same people a placebo for 16 weeks. Neither the volunteers nor the doctors who administered the medication knew during the trial which patients were getting the drug and which the placebo. Procrit's maker, Ortho Biotech of Bridgewater, N.J., sponsored the study.

Blood-hemoglobin concentrations improved dramatically during erythropoietin treatment but not during placebo treatment, Agnihotri says. About two-thirds of the patients attained a hemoglobin concentration above 13 g/dl, he and his colleagues reported last December at a meeting in Atlanta of the American Society of Hematology. The anemia wasn't reduced during the placebo treatments.

"Based on this study, we can say that ... epoetin alfa does increase hemoglobin among chronic-anemic elderly patients," Agnihotri says.

Among the elderly patients whose hemoglobin concentrations went up, their self-assessments of quality of life and energy levels "improved dramatically," says Agnihotri.

Most of the patients in the trial were African American women, but Agnihotri suspects that the results are relevant to all anemic people over age 65, regardless of sex or race.

"This is the first intervention trial to look at correction of chronic anemia in elderly patients," he says. "Before this study, it was unclear whether we should correct anemia in elderly people."

Agnihotri notes that future studies will be needed to determine whether the drug produces lifesaving health benefits and whether it's cost-effective. Currently, each injection costs hundreds of dollars. The benefits of treatment wore off quickly when patients switched to the placebo, so continuous treatment would be necessary to permanently relieve patients' symptoms, Agnihotri says.

Ferrucci says that it will take large trials to justify widespread use of erythropoietin to treat elderly people with anemia. Even then, he says, "it is not a broad solution."

Many elderly people make more than normal amounts of erythropoietin, but their bone marrow doesn't respond by making as many red cells as it should. Ferrucci suggests that chronic inflammation reduces the marrow's responsiveness to the hormone.

Two branches of the National Institutes of Health in Bethesda, Md., last August offered an incentive for further research. The NIA and the National Heart, Lung, and Blood Institute plan to fund up to $10 million of research over a 4-year period.

"The goal of the program is to advance our knowledge about this unexplained anemia, to try to determine why it happens to some older people and not to others, [and to] develop better ways of treating it," says Susan G. Nayfield, chief of the NIA's geriatrics branch.

The institutes have received more than 2 dozen research proposals, Nayfield says. With the scope of anemia in the elderly growing evident, researchers in the field are ready to focus on what to do about it. ■



# OF NOTE

ARCHAEOLOGY

## Jarring clues to Tut's white wine

Scientists studying jars recovered from King Tutankhamen's tomb have extracted the first chemical evidence of white wine in ancient Egypt.

A team led by Maria Rosa Guasch-Jané of the University of Barcelona analyzed the chemical makeup of dried liquid residues on the inside surfaces of six jars from the boy-king's tomb. The jars are now displayed at the Egyptian Museum in Cairo.

Residue in each jar contained tartaric acid, a chemical marker of grapes, the investigators report in the upcoming August *Journal of Archaeological Science*. One jar yielded dark residue that also displayed traces of syringic acid, a substance derived from the main pigment of red wine. The other jars served up yellow or pale-brown residues that lacked syringic acid. Those vessels must have held white wine, Guasch-Jané and her coworkers propose.

Two other jars from Tut's royal grave previously analyzed by the same researchers contained red wine residue.

The new findings show that a jar bearing inscriptions that translate as "sweet wine" originally held white wine, the scientists say. Writing on another white wine container describes it as a gift to Tutankhamen from a prominent Egyptian official.

The oldest written accounts of white wines in Egypt date to the third century A.D., the scientists note. Tut ruled from 1332 B.C. to 1322 B.C., dying under mysterious circumstances at around age 18.

Intriguingly, a red wine vessel was at the west wall of Tut's burial chamber and a white wine container was at the opposite wall. The researchers plan to investigate whether that arrangement held symbolic meaning for ancient Egyptians concerned about the afterlife and rebirth of their rulers. —B.B.

PHYSICS

## As waters part, polygons appear

Imagine a hurricane with an eye in the shape of a propeller amid the swirling clouds. Physicists have observed something almost as strange in whirlpools that they made by swirling liquids in a novel way. Within the whirlpools, they've seen three-blade-propeller shapes as well as regular polygons, including squares and hexagons.

The behavior of liquids in rotating containers has long fascinated physicists. For instance, in a famous late-1600s study, Isaac Newton pondered why the surface of water in a rotating bucket becomes concave.

In the new experiments, Tomas Bohr and his colleagues at the Technical University of Denmark in Lyngby observed liquids in a

cylindrical, Plexiglas container that doesn't actually turn. Instead, a plate attached to a motor-driven shaft spins at up to 7 revolutions per second inside the container, while the vessel itself remains still.

**CURRENT EVENT** A whirlpool, viewed from above, takes a pentagonal shape just above the spinning platter that's causing the water to swirl.

As expected, in experiments with water or with viscous ethylene glycol, the spinning platter swirled the liquid above it to create whirlpools. But the throats of those whirlpools tapered to surprising shapes at the platter's surface, the team reports in the May 5 *Physical Review Letters*.

In the water experiments, those shapes transformed as speed increased, changing from circular to elliptical to propeller-shaped to square to pentagonal and finally to hexagonal. Ethylene glycol whirlpools formed shapes with no more than three sides.

Curiously, the polygons themselves rotated, although more slowly than their parent whirlpools.

Rotating fluids play important roles in systems ranging from industrial equipment, such as pumps, to atmospheric disturbances, such as tornadoes and hurricanes. Although the newfound shapes remain unexplained, Bohr says that their discovery may eventually lead scientists to a deeper understanding of fluids' rotational behaviors. —P.W.

BIOMEDICINE

## Common drugs offer some hot flash relief

A variety of drugs can slightly reduce the number of hot flashes that a woman experiences during menopause, an overview of studies finds.

Studies have shown that estrogen therapy can substantially reduce hot flashes. However, studies of nonhormonal treatments have been less definitive. So, researchers reviewed 43 studies in which a drug or nutritional supplement was compared with a placebo in menopausal women experiencing hot flashes.

The women entered most of the studies averaging six or seven hot flashes per day, says Heidi D. Nelson, an internist and epidemiologist at the Oregon Health and Science University and Providence Health System in Portland.

Receiving a placebo lessened the number of hot flashes by one or two per day, the overview showed. Antidepressants called selective serotonin reuptake inhibitors (SSRIs) and the blood pressure–lowering drug clonidine lowered that tally by one additional hot flash per day, Nelson says. The antiseizure drug gabapentin reduced flashes by two per day beyond the placebo's effect.

Extracts from soy and red clover failed to lessen hot flashes beyond the placebo effect, the scientists report in the May 3 *Journal of the American Medical Association*.

Research suggests that the estrogen loss that precipitates menopause also disrupts the brain area called the hypothalamus, which regulates body temperature. Some doctors already treat women's hot flashes with SSRIs, which may modulate the concentration of the signaling chemical serotonin in the hypothalamus, note Jeffrey A. Tice and Deborah Grady of the University of California, San Francisco in an editorial in the same journal issue. —N.S.

INFECTIOUS DISEASES

## At iconic Asian temple, monkeys harbor viruses

Across parts of Asia, Hindu and Buddhist temples often double as sanctuaries for free-ranging monkeys. Such sites can also shelter monkey viruses, a new report indicates.

Because local residents and tourists frequent these so-called monkey temples, there's potential for cross-species transmission of pathogens, say researchers led by Lisa Jones-Engel of the University of Washington in Seattle.

Their latest study, reported in the June *Emerging Infectious Diseases*, focused on rhesus macaques at Swoyambhu Temple in Kathmandu, Nepal. Photos of that shrine grace postcards and the covers of guidebooks.

The team tranquilized 39 animals—about one-tenth of the temple's monkey population—and took blood samples from them. Lab results show that many of the animals had been exposed to four common monkey viruses: 97 percent of the monkeys showed evidence of exposure to simian foamy virus, 95 percent to rhesus cytomegalovirus, 90 percent to simian virus 40, and 64 percent to herpes B virus.

**SIMIAN SANCTUARY** Almost every monkey at Kathmandu's Swoyambhu Temple carries primate viruses.

Herpes B can be deadly to people, although no person is known to have been infected at a monkey temple. Even after herpes B exposure, monkeys are rarely infectious.

To minimize infection risk, Jones-Engel says, temple visitors should avoid feeding the animals and prevent bites and scratches by covering their skin. Culling infected animals isn't necessary, she argues.

All the macaques at Swoyambhu Temple tested negative for three other viruses, including simian immunodeficiency virus, the evolutionary precursor to the AIDS virus. —B.H.

NEUROSCIENCE

## Evolving genes may not size up brain

Two gene variants previously proposed as contributors to the evolution of human brain size exert no influence on brain volume in people today, a new report indicates. If these particular genes indeed spread quickly by natural selection, that process might have been spurred by the genes' effects on reproductive organs or other tissue outside the brain, say neurologist Roger P. Woods of the University of California, Los Angeles and his colleagues.

Prior research had indicated that a now-common variant of a gene called *microcephalin* originated 37,000 years ago and that a variant of a gene known as *ASPM* arose about 5,800 years ago (*SN: 9/24/05, p. 206*). Mutations in both of these genes have been linked to microcephaly, a disease that causes unusually small head size and mental retardation.

Woods' team used magnetic resonance imaging to measure the brain volumes of 120 healthy men and women from a variety of racial and ethnic backgrounds. Analysis of blood samples from each participant identified those who had inherited the common *microcephalin* and *ASPM* variants and those with either of two other versions of each gene.

After accounting for brain-size differences between the sexes and among ethnic groups, the researchers found that no specific gene variant regularly appeared in individuals with especially large or small brain volumes. The team reports the findings in the June 15 *Human Molecular Genetics*. —B.B.

# Books

A selection of new and notable books of scientific interest

### YELLOW FEVER: A Deadly Disease Poised to Kill Again

**JAMES L. DICKERSON**

Today, people in the developed world view yellow fever as a relic of the past. However, Dickerson explains, yellow fever is a prime candidate for reemergence both as a potential terrorist weapon and as a public health threat borne of global warming. Dickerson begins the book with historical accounts of the United States' most deadly yellow fever outbreaks. Philadelphia in 1793 lost 4,000 residents to the disease. Interestingly, many African Americans seemed to be immune to the disease. Epidemics ravaged New Orleans and other parts of the South during the 1870s. Then, physicians began to understand that mosquitoes spread the disease. Dickerson outlines the various ways in which the warm-weather disease could spread in the United States either as a biological weapon or a natural outcome of climate change. ***Prometheus, 2006, 271 p., b&w photos, hardcover, $25.00.***

### MURMURS FROM THE DEEP: Scientific Adventure in the Caribbean

**GILLES FONTENEAU**

Following a life long dream sparked when he sailed, as a teenager with famed oceanographer Jacques Cousteau, Fonteneau launched his own maritime expedition in 2001. He sailed to the tiny island of Las Aves in the Caribbean to study the movement of tectonic plates and the condition of coral reefs. There, the part-time scientist and his colleagues were met by suspicious Venezuelan soldiers stationed on the island to protect presumed oil reserves. After some explaining and diplomatic wrangling, Fonteneau and his crew were cleared to begin their research, detailed in this account. The author recounts with enthusiasm and vividness his research aboard the 45-foot research vessel *Prince de Vendée*. The work included placing Global Positioning System transmitters to track the movement of the Caribbean tectonic plates. Knowledge being derived from the transmitters could save lives in the event of an earthquake and subsequent tsunamis in the area, the author claims. The team also made underwater-sound recordings revealing surprising fish communications. This first-person narrative is a window on oceanography of the type that Cousteau used to provide. ***Arcade, 2006, 239 p., color photos, hardcover, $25.00.***

### ENGAGING AUTISM: Using the Floortime Approach to Help Children Relate, Communicate, and Think

**STANLEY I. GREENSPAN AND SERNA WIEDER**

Autism or an autistic spectrum disorder (ASD) may affect 1 in every 170 children. The disorders are characterized by a child's failure to develop normal social interaction as well as various language, thought, and movement problems. In this book, Greenspan outlines his treatment method, called the DIR/Floortime Approach, in which a therapist or another adult gets down—physically and intellectually—to a child's level. In the course of explaining his innovative method, Greenspan outlines the various stages of childhood development, describes how to encourage two-way communication and empathy, and explains the unique biology of children with autism and similar disorders. He also describes methods for assessing improvement in these children and for dealing with disordered behavior. An appendix includes studies of this therapeutic approach as well as theories on how autism develops. ***Perseus, 2006, 448 p., hardcover, $26.95.***

### FINAL REPORT: An Archaeologist Excavates His Past

**MICHAEL D. COE**

Coe, professor emeritus of anthropology at Yale University, is an authority on the ancient Maya, Olmec, and Mesoamerican cultures. In this book, he trains his archaeological eye on his own past. His childhood was one of privilege, with a comfortable upbringing on Long Island and an early academic interest in the arts, writing, and biology. A winter vacation from Harvard took him on a trip to Mexico's Yucatán, where he witnessed Maya ruins and decided to scrap his major in English literature. Remarkably, Coe's graduate studies led to a stint as a Central Intelligence Agency case officer in Taiwan. Upon returning to Harvard, he began to hone his focus as an archaeologist and Mayanist. Coe recalls in detail his grueling and fruitful excavations in Guatemala and Tennessee, his early work studying the Olmecs and their predecessors, and his establishment of a successful Mesoamerican program at Yale University before his retirement in 1994. ***Thames and Hudson, 2006, 224 p., b&w plates and illus., hardcover, $29.95.***

### HOPE DIAMOND: The Legendary History of a Cursed Gem

**RICHARD KURIN**

Long before the Hope Diamond arrived in 1958 at the Smithsonian's National Museum of Natural History, it was shrouded in legend. Indeed, many people believed that the famed diamond's alleged curse would bring tragedy to the United States. Kurin, director of the Smithsonian Center for Folklife and Cultural Heritage, discusses the science behind diamond formation as well as the properties that give the famous stone its unique blue color. The author also recounts the 45-carat-stone's rich history, which begins with it being smuggled out of India by the French merchant John Baptiste Tavernier in 1642. According to legend, Tavernier stole the diamond from the eye of a Hindu idol and was soon killed by a pack of dogs. Kurin dispels this myth and others surrounding the precious stone. He describes the long journey of the diamond from its place among the French crown jewels and its purchase by jeweler Pierre Cartier, who manufactured the story behind the diamond's "curse." Eventually, the jewel was acquired by New York jeweler Harry Winston, who turned the diamond over to the Smithsonian. ***HarperCollins, 2006, 400 p., b&w photos and illus., $24.95.***

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# LETTERS

## Latitude adjustments

"Shafts of snow sculpted by sun" (*SN: 4/1/06, p. 206*) doesn't say that *penitentes* appear only in the Andes, nor does it say in what part of the Andes they appear. Does the formation of *penitentes* require that the sun be nearly directly overhead for part of the day? Can *penitentes* form only near the equator?

**BURTON LOUPEE,** CEDAR RAPIDS, IOWA

Penitentes *are also found in non-equatorial regions, says Meredith D. Betterton of the University of Colorado in Boulder. While the sun need not be directly overhead for the snow spikes to form, its midday position affects their tilt. For instance,* penitentes *far south of the equator lean more to the north than equatorial ones do.* —P. WEISS

## Sorry, you lose

I did think the hairy crab was amazing, and I chuckled over the earthworm-eating and drop-down spider stories, although the "male spiders woo lifelessly" slipped right by ("Hairy crab lounges deep in the Pacific," "On a dare, teen advances medical science," "Device rids homes of sounds of rap," and "Wary male spiders woo lifelessly," *SN: 4/1/06, p. 205*). It wasn't until I passed the issue on to my husband that I noticed that the heading said "No Fooling" instead of "Of Note." So now, we have a $20 bet on the veracity of these articles. Please tell me that you were pulling our (hairy) legs.

**DIAN D. REED,** SOQUEL, CALIF.

*All the April 1 stories were authentic, although amusing. That's why we labeled them "No Fooling."* —THE EDITORS

**Corrections** *"Microbe holds fast"* (SN: 4/29/06, p. 269) *should have said that a "10-centimeter-by-10-cm square" of the adhesive described, not a "10-square-centimeter surface," could potentially hold 70 tons. In "Indy's Best: Young scientists cross the finish line"* (SN: 5/20/06, p. 310), *Mary Douglas and Alison Liu of Manhasset (N.Y.) High School received the award for best team project. Liu is 16 years old.*



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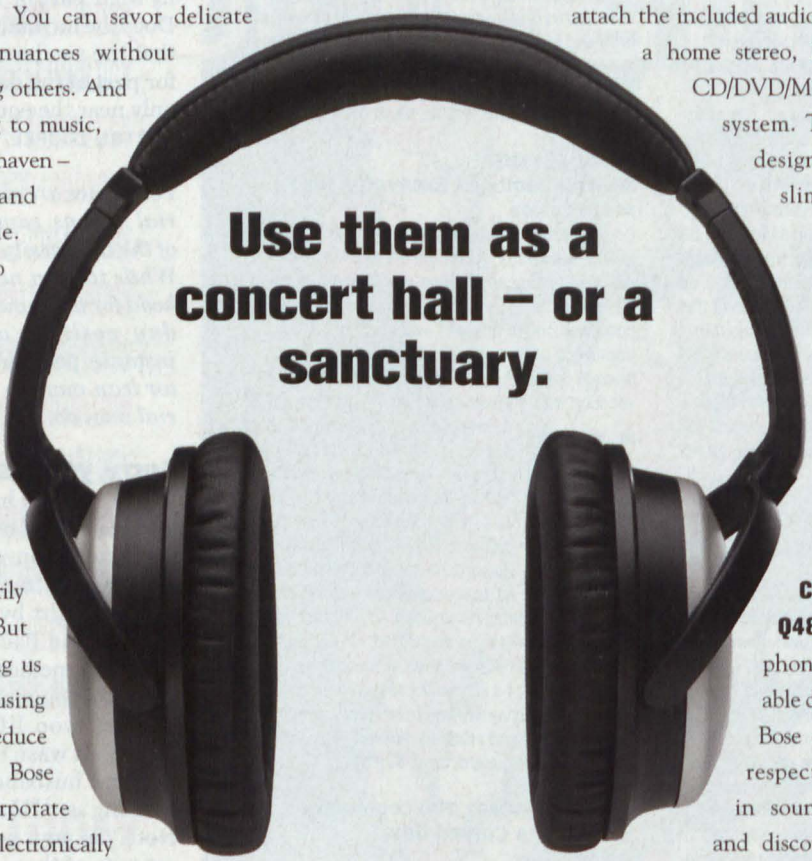

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