

SCIENCE NEWS

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remodeling peer review
comet composition
for fewer sniffles: be happy
feeling no pain

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food frights

STOPPING PRODUCE
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SCIENCE NEWS

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Cover Farmers take many preventive measures to keep produce, such as this spinach, pathogenfree. But to provide even greater food safety, researchers are investigating steps to sanitize produce after the harvest. (Corbis) [Page 394](#)

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Comet Sampler

Specimens show
that inner and outer
solar system mixed

Just as the solar system was forming some 4.6 billion years ago, it turned itself inside out. Some of the hottest material, residing so close to the sun that it almost vaporized, sped out to the chilliest reaches of deep space. These bits of formerly high-temperature dust ultimately became parts of the icy balls known as comets.

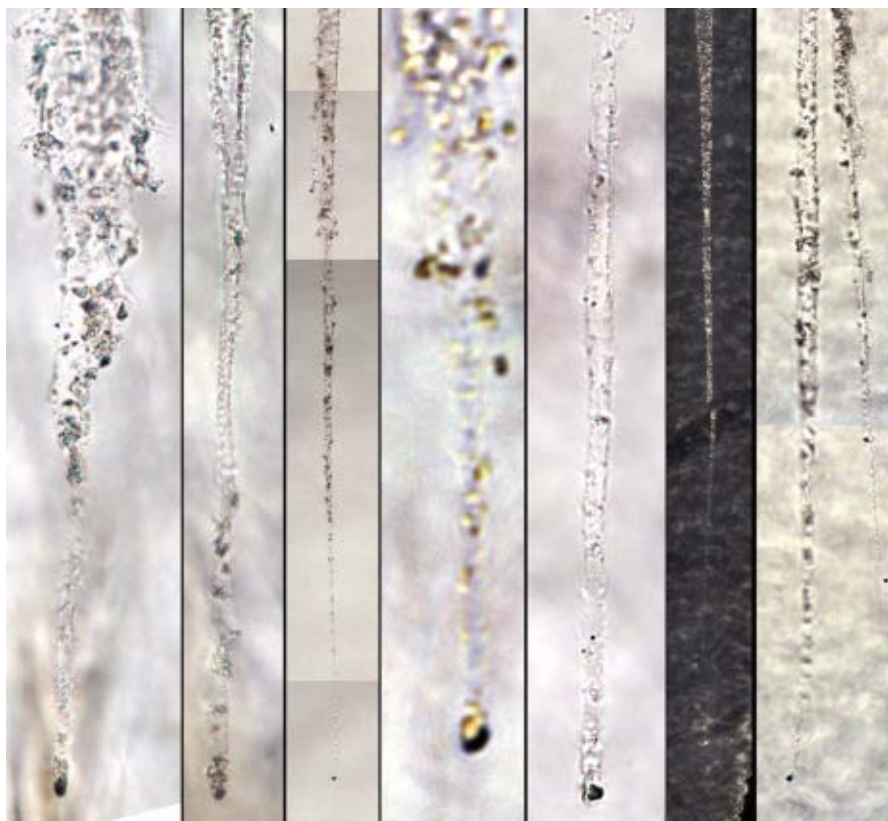
That startling scenario—in stark contrast to a widely held view that outlying regions grew up isolated from the inner solar system—is revealed by the first analyses of cometary-dust grains brought back to Earth by a spacecraft. NASA's Stardust craft passed through the dusty shroud of a comet called Wild 2 in 2004 and last January dropped to Earth a canister of the material that the mission had collected (*SN*: 3/25/06, p. 182).

Researchers filled seven papers in the Dec. 15 *Science* with descriptions of just a tiny fraction of the roughly 10,000 dust grains captured.

Some planetary scientists, including members of the Stardust team, had conjectured that many microscopic comet grains had formed near stars other than the sun and then entered the solar system during its youth. If so, the grains would contain a wide variety of isotopes from elements heavier than lithium.

Instead, Stardust investigator Don Brownlee of the University of Washington in Seattle and his colleagues found that the isotopic composition of nearly every grain that they analyzed matched that of the inner solar system, demonstrating that the rocky material in Wild 2 indeed originated in the solar system.

One specific grain, the second particle that the researchers analyzed, grabbed their attention. The grain consists of calcium-aluminum minerals that could have formed only at the high temperatures extremely close to the sun. That rare mate-



MAKING TRACKS Each vertical panel shows the path that a microscopic dust particle made after entering the aerogel collector carried by NASA's Stardust spacecraft.

rial, sometimes seen in meteorites that have roamed the inner solar system, had never before been detected in a comet.

The particle also contained magnesium olivine, a component of Hawaii's green sand. Like the calcium-aluminum mineral, magnesium olivine was one of the first materials that formed around the young sun.

About 10 percent of the matter in comets, which typically reside beyond the orbit of Neptune in a region called the Kuiper belt, comes from the sun's fiery vicinity, Brownlee and his colleagues calculate. "It is amazing that more than a trace amount of comets comes from the inner, hotter regions of the solar nebula where Earth formed," says Brownlee.

"It appears inescapable that during the formation of the solar system, materials formed near the sun were mixed as far out as the Kuiper belt," notes Don Burnett of the California Institute of Technology in Pasadena in a commentary accompanying the *Science* papers.

Before Stardust, Brownlee notes, planetary scientists recognized that solids from the innermost part of the solar system had reached the asteroid belt, which lies between the orbits of Mars and Jupiter. "But now we know they also reached the region [far] beyond where Pluto is," says Brownlee.

For decades, theorists have proposed that a planet-making disk of gas, dust, and ice surrounded the newborn sun. Frank Shu of the University of California, San Diego

has conjectured that jets of gas or a strong wind generated by the newborn sun hurled into space molten dust particles from the inner disk. —R. COWEN

Sniffle-Busting Personalities

Positive mood guards
against getting colds

People with generally positive outlooks show greater resistance to developing colds than do individuals who rarely revel in upbeat feelings, a new investigation finds.

Frequently basking in positive emotions defends against colds regardless of how often one experiences negative emotions, say psychologist Sheldon Cohen of Carnegie Mellon University in Pittsburgh and his colleagues. They suspect that positive emotions stimulate symptom-fighting substances.

"We need to take more seriously the possibility that a positive emotional style is a major player in disease risk," Cohen says.

In a study published in 2003, his group exposed 334 healthy adults to one of two rhinoviruses via nasal drops. Those who displayed generally positive outlooks, including feelings of liveliness, cheerfulness, and being at ease, were least likely to develop cold symptoms. Unlike the negatively inclined

participants, they reported fewer cold symptoms than were detected in medical exams.

The new study, which appears in the November/December *Psychosomatic Medicine*, replicates those results and rules out the possibility that psychological traits related to a positive emotional style, rather than the emotions themselves, guard against cold symptoms. Those traits include high self-esteem, extroversion, optimism, and a feeling of mastery over one's life.

The latest data also show that among people with a consistently positive mood, well-being doesn't simply reflect physical vigor. All volunteers entered the study in comparably good health.

In that project, Cohen's team interviewed 193 healthy adults by phone each evening for 2 weeks. The participants reported their positive and negative emotions during that day. They then received nasal drops containing a rhinovirus or an influenza virus that causes a coldlike illness.

Each person was quarantined in a separate room and monitored for 5 or 6 days. Although a positive emotional style bore no relation to whether participants became infected, it protected against the emergence of cold symptoms. For instance, among people infected by the influenza virus, 14 of 50 (28 percent) who often reported positive emotions developed coughs, congestion, and other cold symptoms, as compared with 23 of 56 infected individuals (41 percent) who rarely reported positive emotions.

The extent of positive emotions, but not of negative ones, exerted a strong impact on the emergence of cold symptoms, Cohen says. His recent analysis of immune measures from volunteers in the 2003 study, published last March in *Brain, Behavior, and Immunity*, points to enhanced regulation of an infection-fighting substance, interleukin-6, in people with positive emotional styles.

Cohen's current study offers "an interesting twist" on the relationship between feelings and health, remarks psychologist Janice K. Kiecolt-Glaser of Ohio State University in Columbus. Other research indicates that negative emotions influence immune function and illness development more powerfully than positive emotions do, Kiecolt-Glaser says.

However, psychologist Barbara L. Fredrickson of the University of North Carolina at Chapel Hill notes that the new data agree with her work showing that to a surprising degree, positive emotions can bolster the immune system to improve health.



IN HOT WATER Deep undersea near the Axial volcano in the northeast Pacific, the seafloor releases jets of scalding water that carry unusual microbes, including nitrogen fixers.

Studies of the impact of mood on physical health need to account for both positive and negative emotions, Cohen holds. He points to preliminary data from other teams suggesting that among depressed people, a lack of positive emotions is a more accurate predictor of stroke than is the extent of their negative emotions. —B. BOWER

Hottest Fixer

Undersea-vent microbe sets nitrogen record

A spherical microbe from the weird world of hot-water ocean vents has trumped the nitrogen-processing powers of all organisms previously studied.

Like some soil microbes and bacteria living in pea plants and their relatives, the microbe known as FS406-22 turns plain nitrogen (N_2) into a form that other living creatures can use, explains Mausmi P. Mehta of the University of Washington in Seattle. However, FS406-22 does the chemistry at 92°C (198°F). That's 28°C above the record set by the previous champ, a microbe collected from sea sediments near Naples, Italy.

FS406-22 is also the first nitrogen fixer identified in an undersea vent, say Mehta and her Seattle colleague John A. Baross. Vents differ in what forms of nitrogen are available in the water they release, says microbial oceanographer David M. Karl of the University of Hawaii in Honolulu. But if most of the nitrogen is the virtually inert N_2 form, the activity of FS406-22

"would be of great ecological significance," he says. Living creatures use nitrogen in complex molecules, such as DNA and proteins, and nitrogen shortages limit growth in some habitats.

Microbes with enzymes that work at the high water temperatures near vents might have "biotechnological potential," says nitrogen-cycle specialist Douglas Capone of the Oceanographic Laboratory at Villefranche in France. "There is a fair amount of research interest on thermally stable enzymes," he says.

With the limited availability of input from the sunlit world, seafloor vents tend to harbor creatures that have novel chemistry. Mehta set out to find any vent organism that fixes nitrogen under those extreme conditions.

She and Baross pursued this quest for several years during a series of research cruises to the underwater Axial volcano in the northeast Pacific. Scientists on board sent down robotic collection vehicles with arms that poked into gashes in the seafloor. They brought back samples that "look like water," says Mehta, but have a "nasty, rotten-egg smell."

Mehta put vent-water samples into containers of various nutrient soups that only a nitrogen-fixing microbe could love. In hundreds of containers where the only nitrogen was in the N_2 form, she ended up with nothing. In 2004, however, one batch of containers turned cloudy with a thriving microorganism that Mehta designated FS406-22.

Under a microscope, FS406-22 looks "mundane," Mehta admits. It clumps into groups of two or three cells. When Mehta

and Baross sequenced a bit of DNA, they found that FS406-22 is an anaerobic archaean, a one-celled organism that looks like a bacterium but has chemical similarities to multicelled organisms. Furthermore, FS406-22 thrived in nutrient broth that Mehta had dosed with antibiotics that kill bacteria.

The new microbe may give clues to the distinguished history of nitrogen fixing, which probably evolved before photosynthesis. Mehta and Baross analyzed the three genes that encode the proteins in the enzyme complex that drives nitrogen capture. They appear to be the most ancient ones yet seen and may resemble the nitrogen-fixing genes in the common ancestor of archaea, bacteria, and multicellular life, the researchers say in the Dec. 15 *Science*. —S. MILIUS

Spread Out

Organic matter scatters carbon nanotubes in water

Although carbon nanotubes usually clump in water, they readily disperse when the water contains natural organic matter, researchers report. Their study provides

a glimpse of how the nanotubes might behave if released into a waterway.

Carbon nanotubes are prized for their strength and electrical properties (*SN*: 6/14/03, p. 372), and their production and market continue to grow. Researchers have reported that in the laboratory, these nanoparticles are strongly repulsed by water and attracted to each other. But scant information exists about how the tubes would behave in the environment, notes Jae-Hong Kim, an environmental engineer at the Georgia Institute of Technology in Atlanta.

Kim and his colleagues set out to see whether the decayed plant and animal material found in waterways would affect carbon nanotubes. The scientists used multiwalled nanotubes, each of which is a collection of concentric tubes.

The organic matter came from the Suwannee River in Georgia. The researchers used water that they collected from the river and a prepared powder that they purchased and diluted.

Team members added the carbon nanotubes to flasks containing either the river water or a solution of the powdered organic

matter. They also added the nanotubes to two other flasks containing either distilled water or a surfactant solution that scientists routinely use to keep carbon nanotubes from clumping during experiments. The team shook all the flasks for an hour, let the contents settle, and then observed them for over a month.

As expected, all the nanotubes in the distilled water rapidly clumped and most settled at the bottom of the flask, whereas in the surfactant solution, some nanotubes dispersed. To the researchers' surprise, says Kim, the nanotubes dispersed most readily in the presence of either type of natural organic matter. The team reports its findings online in

Environmental Science & Technology.

The researchers suspect that, like a surfactant, the organic material coats the carbon nanotubes. Surfactants change nanotubes' surface chemistry, making it easier for the particles to disperse individually.

Although the work is preliminary, says Kim, it indicates that if nanotubes were to contaminate a waterway, "you can easily imagine that they [could] transport very well in the water."

QUOTE

“The surprising thing ... is that the dispersing agent can simply be the natural organic matter in the water.”

MASON B. TOMSON,
Rice University

Feel No Pain, for Real

Mutation appears to underlie rare sensation disorder in a Pakistani family

Scientists have tracked down a genetic mutation that makes some members of an unusual Pakistani family fail to sense pain.

Although pain can be agonizing, it does serve a useful function—it teaches people and animals to avoid dangerous situations and forces them to attend to wounds. However, a handful of people have genetic conditions that prevent them from feeling pain. This rare lack of sensation is often detrimental; people with the condition can be unaware of having suffered significant injuries.

Several years ago, medical geneticist C. Geoffrey Woods of the University of Cambridge in England and his colleagues began working with children from a family in northern Pakistan in which several members can't sense pain. The team's first research subject, a 10-year-old boy, was well known in his

community for street performances in which he placed knives through his arms and walked on hot coals. Despite tissue damage, he apparently felt no discomfort.

Wondering what could cause this boy and other family members to lack pain sensation, Woods' group scanned the genomes of six of the other children who were affected by the condition. The researchers searched for genetic quirks that weren't shared by family members with normal pain sensation. The team eventually zeroed in on mutations in *SCN9A*, a gene that encodes part of a cell-surface channel that lets sodium into pain-sensing nerve cells as part of signal propagation.

In separate experiments, the researchers tested how these mutations might affect the sodium channel's function. The team caused kidney cells, which don't naturally have the

channel, to display either the normal or the mutant channels on their surfaces. When the scientists stimulated the cells with electric current, the normal sodium channels opened and sodium ions flooded into the cells. In contrast, electric current didn't open the mutant channels.

The researchers say in the Dec. 14 *Nature* that people with such mutations in their *SCN9A* genes probably have a similar loss of sodium-channel function in their pain-sensing nerve cells. However, these cells' membranes also contain sodium channels that aren't affected by the mutation, so the team isn't sure why the affected individuals feel no pain.

"This paper shows that rare diseases can still be of great importance because of the insights they give into biological and developmental processes," Woods says. He

notes that continuing to study the Pakistani family members could lead to a better understanding of the general mechanisms behind pain.

People with some types of chronic pain have on their pain-sensing nerve cells an abnormally high number of sodium channels containing the protein encoded by *SCN9A*, according to research by Yale University neurologist Stephen G. Waxman. In a commentary that accompanies the *Nature* report by Woods' team, Waxman adds that if researchers could craft a drug to make these channels inactive, as they are in the Pakistani family members, they could help millions of people worldwide who suffer from chronic pain.

"This research could give pharmaceutical companies a valuable lead," Waxman predicts. —C. BROWNLEE

"The surprising thing about this work is that the dispersing agent can simply be the natural organic matter in the water," comments Mason B. Tomson, an environmental chemist at Rice University in Houston.

Tomson adds that the next step is to study how other natural factors, such as water flow, microorganisms, and sediments, might affect the distribution of nanotubes. Then, researchers could examine the toxic effects of the suspended tubes.

"This is just one of a number of studies that would need to be done to understand the fate of these materials in practical environmental systems," Tomson says. —A. CUNNINGHAM

Catching Flu's Drift

Vaccines fight unexpected influenza

Vaccination can prevent three of every four flu infections, even when the vaccines are imperfectly tailored to block the common wintertime pathogens, a new study shows. That finding is reassuring, researchers say, because it's difficult to anticipate how the flu virus will evolve each year during the time from the start of vaccine manufacture to deployment.

The flu reinvents itself from year to year through a process in which previously rare variants of the virus supplant once-dominant ones. Since a vaccine trains the immune system to spot viruses by their unique surface proteins, a vaccine may work poorly if an unexpected variant dominates the flu season.

Past research has shown that injected and inhaled vaccines perform comparably, with efficacy as high as 90 percent, when the vaccine is on the mark. But in about 3 years out of every 10, designers guess incorrectly which variants of flu will predominate, says Arnold Monto of the University of Michigan in Ann Arbor.

In one such year, the new study found that a conventional flu shot called Fluzone was more effective than a newer, inhaled vaccine called FluMist.

Monto and his colleagues conducted the study during the 2004-2005 flu season, when the dominant flu variant wasn't among those targeted by that year's vaccines.

In late 2004, the researchers injected

the Fluzone vaccine into the shoulders of about 500 healthy adults in Michigan. They gave a similar group of volunteers the intranasal FluMist spray. About 200 people received a placebo that resembled either the shot or the spray.

During the subsequent flu season, which began in January 2005, about 4 dozen of the participants developed influenza.

Compared with people who had received a placebo, those who got the spray vaccine developed flu about half as often, and those who got the injected vaccine fell ill only one-quarter as often, the researchers report in the Dec. 14 *New England Journal of Medicine*.

"We have two effective vaccines," Monto concludes. The shot's efficacy of 75 percent is surprisingly high, given that it wasn't designed to target that year's dominant flu strain, adds Monto, who has been a paid consultant for MedImmune, the maker of the inhaled vaccine.

In the study, both type A and type B influenza viruses caused illness. The type A group includes the most common agents of influenza and the targets of flu vaccines.

The two types of vaccine performed similarly against influenza type A, Keiji Fukuda and Marie Paule Kieny of the World Health Organization in Geneva note in the journal issue. However, the injected vaccine performed twice as well as the intranasal spray against the type B strains.

Type B strains are becoming increasingly common, Monto says. —B. HARDER

A Fair Slice

New method makes for equitable eating

Sometimes, a birthday celebration goes awry when a pair of partygoers squabble over the cake, both preferring the slice with the cherry or with the thickest icing. That sort of spat caught the attention of mathematicians, inspiring a new idea for making divisions fairly.

The problem hinges on the definition of *fair*. Steven Brams of New York University and his colleagues propose that a division is fair if, after it's made, each person's assessment of the value of his or her piece is the same. In the December *Notices of the American Mathematical Society*, the team reports a new method of cake cutting that ensures this result.

The classic way for two people to share a cake without argument is known as "I cut, you choose." To divide an elaborately decorated sheet cake strewn with nuts and coconut, I'd cut the cake into two pieces that seem to me to be of equal value, though not necessarily equal size. If I particularly like nuts, for example, I would divide the

cake into unequal pieces, the smaller piece getting more nuts, to make sure that I'm satisfied with whichever slice remains after you've made your choice.



COOPERATION CALCULATION In dividing this cake, A marks the cut where I think the two pieces have equal value, and B shows the division where you think the pieces are equal. By a new method, I'd get the leftmost piece, you'd get the rightmost piece, and we'd share the middle section.

But, that division might not provide pieces that we value equally, thus being unfair by Brams' definition. Although from my perspective, either piece is half the value of the cake, the slice you choose may, from your perspective, be much more than half the cake's value. For example, if you like coconut, the bigger, less nutty slice might have extra value if it has more coconut than the other.

Brams' new procedure avoids this problem. You and I each report to a third person—a referee—how we value the cake. The referee then finds the place where I would choose the cake to be divided into two shares of equal value and the place you would choose.

If the two spots are the same, the referee divides the cake there, and we'd each be satisfied with our shares. But suppose the two spots are different. The referee would assign to me whatever portion of the cake stretches from my selected spot to the end of the cake but doesn't include your spot. The referee would do the same for you. That would give us each what we regard as half the cake's value. Then, the referee would divide the leftover bit, giving us each a bonus that we value equally.

Brams says, "The cake is really a metaphor for any heterogeneous good where different people value it differently." A practical example might be the joint property to be divided in a divorce.

James Tanton, a mathematician at St. Mark's School in Southborough, Mass., calls the work exciting but cautions that it's not very useful. "I don't know if anyone other than me has actually brought a cake in and tried to divide it," he says. "It's impossible, because human beings ... change their minds." —J.J. REHMEYER

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PEER REVIEW UNDER THE MICROSCOPE

One journal's experiment aims to change science vetting

BY CHRISTEN BROWNLEE

This September, physicist Sergey Kravchenko of Northeastern University in Boston did something that scientists do hundreds of times over the course of their careers: He and his colleagues submitted their latest research findings to a scientific journal. The researchers had performed a study that they say experimentally verifies a theory on how electrons interact in semiconductors. They submitted their report to the prestigious journal *Nature*.

Getting findings published, either on paper or on the Web, is the final step in entering a researcher's work into the scientific record. To make sure that the research is worthy of joining this hallowed collection, most journals use a method called peer review.

Put simply, peer review subjects scientists' work to the scrutiny of other scientists in the same field. These typically anonymous reviewers weed out research with flawed methods or conclusions and work that isn't a good fit for a particular journal. They also provide feedback to improve the scientists' work and validate outstanding research.

The peer review process has changed little from journal to journal for centuries, and Kravchenko was expecting that his most recent paper would get vetted through the same process that put his 80-odd earlier papers into print. This time, however, an e-mail from *Nature* invited Kravchenko to participate in a peer review experiment. Besides sending research articles to two or three anonymous reviewers, the journal was posting some papers on a Web site where any interested scientist could voice his or her opinions about the research, as long as the commenters revealed their identities.

"I said, 'Of course we'll participate.' The more people know about our work, the more feedback we'd get, and the better our research would be," Kravchenko says.

Opening the peer review process to the larger scientific community could have multiple benefits—scrutiny by a broader audience may give study authors more ideas for improving their research and catch more low-quality and fraudulent papers before they enter the scientific record. But posting papers before they're published might also open scientists' work to plagiarism or the possibility of being scooped by competing labs.

Nature's peer review experiment is over, and the journal is now analyzing the results. But if the trial pays off, the traditional method for communicating research could get its biggest facelift in hundreds of years.

PEERING AT REVIEW The peer review process that most journals use got its start in the early 1700s. Since then, journals have streamlined the process. *Nature's* version of traditional

peer review is a typical one, explains Linda J. Miller, the journal's executive editor.

When scientists send a research article to *Nature*, a group of editors on the journal's staff makes a first-pass decision on its quality and suitability for the journal. If the paper makes that initial cut, the editors select a few researchers considered authorities in the appropriate field of science and ask them to read the manuscript. Those reviewers, also called referees, then read the report and privately voice their opinions. Most journals don't reveal the identities of reviewers. The guarantee of confidentiality allows reviewers to be candid without fearing backlash from study authors.

These reviewers check the paper against a set of criteria: Is the experiment's setup sound? Do the results make sense? Are the conclusions plausible, and are they novel and significant enough to make a contribution to the scientific record?

"I thought [Nature's experiment] was a gutsy move that seemed long overdue."

— DIANE SULLENBERGER,
THE PROCEEDINGS
OF THE NATIONAL
ACADEMY OF SCIENCES

If the referees answer yes to these questions, journal editors usually accept the article for publication. Any negative feedback could send the paper back to its authors with a rejection notice or suggestions for improvement and resubmission.

Even though this traditional method works well, says Miller, "it's a double-edged sword." Serving as a referee can take a significant amount of a scientist's time, so journals such as *Nature* usually choose only two or three reviewers for each paper. This small number

of reviewers can miss significant shortcomings or instances of outright deception. Furthermore, while a referee's anonymity provides protection from a rejected author's wrath and enables the reviewer to openly offer constructive criticism to a known colleague, it also means that referees with biases or grudges against authors can reject a paper, sting a rival, and yet face no negative consequences.

Study authors often complain about the secretive nature of traditional peer review, Miller notes. While new technologies have encouraged science and society to become more open, the workings of this old-school system have remained shrouded. With Web bulletin boards, listservs, and Web diaries, or blogs, cranking out scientists' thoughts continuously, "people are more open about things that previous generations were private about, and now they expect other people to be more open too," says Miller.

COMMENTING CENTRAL Miller explains that the editors at *Nature* wondered whether this boom in openness might benefit peer review. In June, they launched a 3-month trial to find out.

The new, experimental form of peer review was to be identical to the old system, with one important tweak: During the several weeks that referees were considering a paper's merits, study authors had the option of having their research article posted on a Web site so that anyone could read it. Like a blog, each paper posted on the site had a place for comments, though only scientists associated with a research facility were permitted to post them. All comments—their authors identified—were also publicly available for anyone to read.

When referees turned in their anonymous comments on a submitted report, it was moved from the Web site and the comment period closed. *Nature's* editors could then base their decision to accept or reject a manuscript on the comments from both the referees and all the scientists who had posted to the site.

"The idea was we'd go from two or three people's advice to the advice of as many who would care," says Miller.

Gathering such unofficial comments and suggestions isn't a new idea to researchers in the physical sciences, says physicist Neil Mathur of the University of Cambridge in England, who like Kravchenko chose to post his team's paper on *Nature's* Web site. Since the early days of the Internet, researchers in various fields related to math, physics, and astronomy have posted their research reports on preprint servers—Web sites where scientists can gather comments and suggestions from their peers on how to improve their papers before submitting them to mainstream journals.

For such scientists, says Mathur, "putting [papers] on *Nature's* server is no big deal."

In contrast, says Miller, researchers in the biological sciences rarely release study results before they're submitted for publication or presented at meetings. This split between the disciplines probably played a strong role in researchers' decisions of whether to participate in *Nature's* experiment. Most papers submitted to the peer review Web site were in the physical sciences, with just a handful of biology papers posted, says Miller.

Regardless of the field in which a paper was classified, the potential payoff for joining the experiment was clear to Kravchenko. If a study is of high quality, he notes, the positive comments it's likely to attract will help it get accepted into *Nature*. And if a paper could use some fine-tuning, then perhaps the open review process could garner helpful suggestions for the research.

The incentive for commenting on others' papers was cloudier, Mathur notes. Although he would have liked to have some comments on his own paper—by the end the experiment, it had none—he points out that reading papers and voicing opinions could be burdensome for scientists who are already strapped for time.

"It's work," says Mathur. "I haven't been motivated to see if there's a paper I'd like to comment on because I have plenty of other things to do."

FINAL DECISION At the end of September, *Nature* ended its experiment. Did it pay off?

In total, 72 research teams contributed their articles to the experiment, and 95 commenters posted their opinions. Most of the comments were given to just a few papers, and almost half of the papers received no comments at all.

Miller notes that these comments weren't nearly as thorough as those that official reviewers are expected to make. "They're generally not the kind of comments that editors can make a decision on," she says.

While Miller isn't sure why more study authors didn't participate in the experiment, she speculates that researchers may have feared that putting unpublished work out in the open could leave them vulnerable to theft of their ideas. "People are afraid of being scooped," she says.

Experiments in Progress

Journals customize peer review

Though most journals use a review system much like *Nature's* traditional one, a growing number of science publications are choosing alternative methods that give readers a chance to offer their opinions.

For example, *Atmospheric Chemistry and Physics*, which launched 5 years ago, initially publishes online the submissions that make a first cut as "discussion papers," explains executive editor Ulrich Pöschl. During an 8-week period, both official referees and any interested scientists can post comments on these papers in a public forum, choosing to stay anonymous or to sign the remarks. Afterward, the journal's editors use the entire discussion to decide whether to publish the article in printed form.

"What we offer with discussion papers is strong papers and free speech very quickly," Pöschl says.

Philica, an online interdisciplinary journal that's still in testing, offers a new twist for incorporating readers' opinions. Every report that's submitted to the journal is posted online without initial review. Then, readers with academic credentials can leave comments and numerically rate papers on scales that cover such factors as originality and importance.

"It's been described to us as eBay for academics," says Nigel Holt, a psychologist at the University of Bath in England and one of *Philica's* founders.

Just as eBay's users rely on ratings to judge the quality of buyers and sellers, *Philica's* users can lean on ratings to judge the quality of scientific papers.

"You wouldn't want to buy something from someone rated extremely low," Holt says. —C.B.

Giving her initial take on the experiment, Miller adds, "I am not convinced that it was a value to the editors—enough value to change our processes permanently." She wouldn't predict whether *Nature* will repeat the experiment or use it as a guide to change its current peer review system.

But even with the experiment's somewhat disappointing results, other high-profile journals are taking notice.

"We're following the experiment with interest," says Monica Bradford, executive editor of *Science*. "Peer review is central to scientific communication, and it's important that we're open to examining the peer review process to ensure that it remains a reliable means of vetting research."

Diane Sullenberger, executive editor of the *Proceedings of the National Academy of Sciences*, agrees. "I thought [*Nature's* experiment] was a gutsy move that seemed long overdue," she says. "I'm not sure if open peer review in and of itself would solve the problems with the peer review system now, but the only way we can tell is by conducting experiments such as these."

Nature is still crunching numbers and plans to survey the experiment's participants, before declaring the trial a success or failure. Regardless of the final outcome, Kravchenko notes that he and his team have been pleased to participate—their paper ended up with 10 comments, more than any other paper in *Nature's* trial. "It's definitely been a good experience for us," he says.

It's hard to say whether the Web comments helped or hurt Kravchenko's attempt to publish in *Nature*. The paper was rejected even though the public comments were generally positive. The team plans to revise its paper—on the basis of the official comments—and to resubmit it to *Nature* soon. ■

SALAD DOUBTS

Preventing and controlling pathogens on produce

BY AIMEE CUNNINGHAM

Spinach's healthy reputation suffered a severe blow this fall. On Sept. 13, the Centers for Disease Control and Prevention in Atlanta learned that the raw leafy green was the prime suspect in a spate of virulent *Escherichia coli* infections. The next day, the Food and Drug Administration advised consumers not to eat any bagged fresh spinach. Two weeks later, the FDA announced that it had traced the tainted greens to one California company that bags spinach under several brand names. Fresh spinach from other suppliers soon began reappearing on store shelves and dinner plates. The outbreak's toll, according to the CDC: 3 deaths and more than 200 people sickened in 26 states and 1 Canadian province.

Federal and state officials have found the implicated bacterial strain in cow feces, water, and wild pigs at sites near the four suspected spinach farms in California, but they still don't know how the pathogen got to the greens. Officials continue investigating the incident, says Patti Roberts, a spokeswoman for the California Department of Health Services.

The spinach outbreak joins a growing list of health-related incidents tied to vegetables and fruits. According to the CDC, there's been an increase in such outbreaks in the past few decades.

The rise in produce-related illnesses can be linked to several factors. With people becoming savvier about their health, fresh-produce consumption has grown, notes Robert B. Gravani, a food scientist at Cornell University. During this time, however, more-dangerous microbial strains have emerged, he adds.

For example, the unusually virulent *E. coli* O157:H7 was first isolated in 1982, after an outbreak tied to contaminated hamburgers. A strain of that same bacterium was responsible for the spinach illnesses.

The food-distribution system also plays a role. "The production of fresh produce is much more centralized than it used to be, and [produce] gets distributed very widely and rapidly. There-

fore, one contaminated field may lead to a multistate outbreak that affects a large number of people," says Maria T. Brandl, a microbiologist with the U.S. Department of Agriculture's Agricultural Research Service in Albany, Calif.

Finally, detection strategies have improved, notes Larry R. Beuchat, a food microbiologist at the University of Georgia in Griffin. He suspects that many outbreaks of illness of unknown provenance that occurred 20 or 30 years ago "would today, with the technology available, be confirmed or at least linked to particular types of [contaminated] produce."

Preventing such contamination, from the farm to the dinner table, is the key to food safety, say many researchers. But farmers can't stop all contamination, and once tainted, many fruits and vegetables are difficult to clean. So, for the rare times when unwanted microbes make their way onto a farmer's crop, researchers are exploring new strategies and technologies to destroy these pathogens and to keep produce—and its consumers—healthy.

ON THE FARM A typical vegetable's journey to market is full of potential contamination sources. Water that contains pathogens can come into contact with crops both during irrigation and in subsequent washing of harvested produce or its storage in ice. Animal feces can reach produce if domesticated or wild animals roam in the fields. Workers and equipment, such as bins or knives, can taint produce during the harvest or in later production steps.

To reduce the risk of contamination, the FDA in 1998 published recommendations for good agricultural

practices (GAPs). This set of guidelines addresses issues that farmers must consider at various stages of the growing and harvesting process. For example, before applying manure to the fields, farmers must compost or treat it to remove pathogens.

"I honestly believe that if everyone was diligent about it, applying the principles of GAPs would ... go a very long way to preventing outbreaks," says Trevor V. Suslow, a plant pathologist and food-safety specialist at the University of California, Davis.

While "prevention is the best strategy we have," says Gravani, "it's not a simple task." The guidelines don't specify a single approach on how to achieve all the recommended practices because there's huge diversity among farming operations.

"Every farm is different, and every situation is different," says Gravani. The appropriate strategies, he adds, depend upon "the environmental conditions that beset you as a farmer."



FIELDS OF GREEN — Sprays of water irrigate spinach fields in Salinas, Calif. A virulent *E. coli* outbreak that sickened more than 200 and killed 3 this fall was linked to four spinach farms in California.

For example, a farm's size, location, and even the time of year influence whether it accesses groundwater from wells or surface water from a river or creek, notes Suslow. Water from any of these sources can be dirtied by runoff from a dairy farm or other contaminated land surfaces, but strategies to maintain good water quality will differ according to the water's source.

The needs of the crop also affect irrigation practices. Under-ground-drip irrigation minimizes contamination risks because the water, which may carry pathogens, isn't applied directly to the edible portions of most plants that will be eaten raw. But drip irrigation isn't suitable for all crops and environments. If growers use spray irrigation, which showers edible portions of many plants, they must take other measures to combat contamination.

"That's why the guidelines are just that—principles of food safety," says Suslow. "It's incumbent on everybody to understand what it is exactly that they are doing ... and what the risk factors are."

In response to the spinach debacle, a few organizations, such as the Western Growers, an agricultural trade association in Irvine, Calif., have called for mandatory compliance with guidelines for spinach and leafy greens.

Much of the "controversy and anguish" on implementing mandatory guidelines, however, is "How do you set criteria in a way that is meaningful?" Suslow says. "You can't just mandate, 'You will have a deep well, and you're only going to use drip irrigation.'"

CHEMICAL CLEANERS

Researchers have been searching for decontamination technologies that can back up preventive practices. An ideal treatment wouldn't damage fruit and vegetables as it kills pathogens and wouldn't leave a residue "that would cause any concern," Beuchat says. The treatment should also be inexpensive. In terms of effectiveness, a 99.999 percent reduction of pathogens "is what we are shooting for," says Richard H. Linton, a food microbiologist at Purdue University in West Lafayette, Ind.

Growers and processors today usually use chlorine as a sanitizer, adding it to the water in which they wash produce. The main role of chlorine is to prevent a contaminated piece of produce from spreading pathogens to other pieces during washing. The rule of thumb for chlorine, says Suslow, is that an effective concentration will kill 99.999 percent of the microorganisms in the water and 90 to 99 percent of the microbes on produce surfaces.

Excessive chlorine damages produce and poses health and environmental concerns. Highly concentrated chlorine solutions can give off gases harmful to workers, and discharging large amounts of the chemical into waterways can affect aquatic life. The Environmental Protection Agency limits chlorine concentrations to 200 parts per million for the water used to clean produce that won't later be rinsed in fresh water.

Some researchers are looking for alternative chemical sanitizers. In an upcoming *Journal of Food Protection*, food microbiologist Alejandro Castillo of Texas A&M University in College Station and his coworkers in Mexico report on a spray that contains 2 percent lactic acid, a chemical used to sanitize carcasses in the meat industry. The researchers first contaminated cantaloupes and bell peppers with either *E. coli* O157:H7 or *Salmonella typhimurium* and then sprayed the lactic acid solution onto the produce for 15 seconds. The treatment reduced the bac-

terial populations on the cantaloupes by close to 99.9 percent and by slightly more on the smooth-surfaced bell peppers.

Linton has been conducting studies with chlorine dioxide gas, the sanitizer that was used to treat anthrax-tainted mail in 2001. In lab tests, his team placed the produce in a desktop-size chamber and then pumped in the gas.

The group has tested the gas on apples, green peppers, cantaloupes, strawberries, tomatoes, sprouts, and lettuce. "We find that it's extremely effective for most products," Linton says. For example, in a 2003 study, the researchers reported that treatment with chlorine dioxide gas at a concentration of 7.2 milligrams per liter for 10 minutes removed more than 99.999 percent of *E. coli* O157:H7 from apples' skins. The produce industry would prefer a process that takes no longer than 15 minutes, he says.

Like the chlorine solutions currently used in industry, chlorine dioxide gas kills microorganisms by oxidizing them. But for leafy greens, some concentrations oxidize cut surfaces, turning them white or brown. Linton plans to explore whether modifications of the technique can make it applicable to the greens.

The chemical residues that remain on the produce after the gas treatment are within the range considered safe in drinking water, he says. The team is in the process of seeking FDA approval for the treatment, after which the researchers can test whether it alters the taste of produce.

The group has recently developed a 7-meter-long, 2-m-high, commercial-scale device. A conveyor belt moves the produce through three chambers. The first chamber rinses the food with water to remove dirt. The second

chamber exposes the food to chlorine dioxide, and the third gives the food a final water rinse.

"It's pretty easy to do things in a lab," Linton says. "Now, we want to subject 500 strawberries in a real-life [commercial] processing situation."

BATHS AND BEAMS Some scientists are looking beyond chemical sanitizers for decontamination options. Bassam A. Annous, a microbiologist with the USDA's Agricultural Research Service in Wyndmoor, Pa., has developed a pasteurization technique for cantaloupes. It reduces salmonella populations on cantaloupe surfaces by 99.999 percent.

Annous and his colleagues built a commercial-scale tank that can process up to 360 melons per hour. A conveyor grabs a melon and immerses it in water heated to 76°C, which is hot enough to kill bacteria. In 3 minutes, the conveyor propels the submerged melon across the tank and out the other end. The researchers immediately seal each melon in a bag and then cool it in ice water. They are developing a cooling method that would work better on an assembly line.

The brief heat treatment isn't detrimental to the flesh of cantaloupes because they have thick rinds, Annous says. The edible portion of the fruit begins about 5 millimeters below the rind. In the March *Journal of Food Science*, his team calculated that for the first millimeter below the surface, the heat rises rapidly enough to kill microbes. But the flesh of the fruit 10 mm below the surface stays below 36°C.

That's cool enough to preserve the fruit's quality, says Annous.



PICK ME — A crew harvests lettuce in Yuma, Ariz. Good worker hygiene is among the prevention measures taken to keep the nation's produce free of pathogens that can contaminate the food supply.

In tests so far, fresh-cut pieces of pasteurized cantaloupes maintained their color, odor, and vitamin C content.

Annous says that he hopes that his group will soon team with industry to test the technique in production facilities.

Some researchers propose that irradiation, a technique that the USDA approved for poultry in 1992 and for meats in 1999 (*SN*: 1/15/00, p. 40), may be useful to decontaminate some produce. Castillo and his colleagues at Texas A&M University have treated cantaloupes and tomatoes with an irradiation method that uses electron beams. Meat producers that irradiate their products employ either electron beams or gamma rays.

In the March *Journal of Food Protection*, Castillo and his team describe irradiation of fresh-cut tomato cubes infected with one of two strains of salmonella. The treatment reduced populations of one strain by 99 percent and the other by 90 percent. The group hasn't yet conducted taste tests of the tomatoes. Castillo says that he's currently trying the technique on spinach.



MELON MOVER — This commercial-scale pasteurization device can process up to 360 cantaloupes an hour. It submerges the melons in hot water to destroy pathogens on the rind.

Like other treatments, irradiation isn't appropriate for every type of produce. Castillo says that the method damages the texture of grapes and some other fruits and vegetables. Moreover, "some foods will lose nutritional power—for example, some vitamins are affected by irradiation," Castillo says. He adds that fruits and vegetables need to be tested individually to see how each one fares under the treatment.

Irradiation also requires expensive equipment. Growers would have to send produce to regional centers for treatment, Castillo says, because it is unlikely that a single plant could afford the machinery.

BACK TO SQUARE ONE Among the sanitizers and technologies under review, "there are promising developments," says Beuchat, but "there's still room for improvement."

Rather than look to a single treatment, the most effective approach to sanitizing produce may be to combine several strategies that remove and kill pathogens, says Brandl.

Moreover, when more is known about how pathogens find their way onto produce, researchers may come up with new methods to prevent contamination. Brandl says that researchers need to determine, for example, the harmful bacteria's preferred locations on plants and their interactions with normal microbial populations that live there.

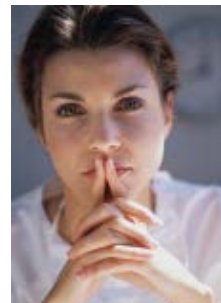
"Once we have sufficient information about critical risk factors," she predicts, "we'll be able to come up with additional, specific guidelines for the safe production of fresh fruits and vegetables." ■

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TECHNOLOGY

A nano-cheese slicer

A thin wire cuts through cheese more easily and cleanly than a flat blade does. Now, researchers have built a microscopic version of a cheese slicer—with a carbon nanotube for a wire—that's aimed at making improved slices of frozen cells.

Biologists have long used diamond blades, known as microtomes, to section flash-frozen cells into thin slices in preparation for microscopic scrutiny. However, such a wedgelike blade bends the top of the slice as it cuts, often creating cracks in the sample, says mechanical engineer Paul S. Rice of the Boulder campuses of the National Institute of Standards and Technology and the University of Colorado.

Using an electron microscope, he and his colleagues steered a micromechanical probe capable of 5-nanometer motions to pluck a single nanotube from a mass of twisted strands. Then, the researchers fired the beam of the electron microscope to spot weld the tube between the tips of two tungsten needles.

So far, welds have failed when the team has tested the nanotube setup's strength with the tip of an atomic-force microscope, reported team member Gurpreet Singh of the University of Colorado in November at a mechanical engineering conference in Chicago. However, better welds are on the way, says Rice, and the team has begun initial cutting experiments on softer-than-ice materials. —P.W.

ASTRONOMY

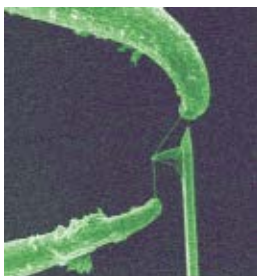
The magnetic link between star and planet

Astronomers say that they have for the first time directly measured the magnetic field of a star known to host a giant planet.

Although the magnetic field of the star, called Tau Bootes, is only a few times as strong as that of the sun, it probably wields

enormous influence on the planet, say the researchers. That's because the orb whips around Tau Bootes at just one-twentieth the distance that Earth circles the sun.

To measure the field, Claude Catala of the Observatory of Paris and his colleagues examined the polarization of light from the star using a device on the Canada-France-Hawaii Telescope on Hawaii's Mauna Kea. Light waves are composed of electric and magnetic fields that oscillate in specific directions. The extent to which light coming from the star is polarized indicates the strength of a magnetic field along a particular direction.



CUT UP Pressure from an atomic-force microscope tip bends a carbon nanotube suspended between tungsten needles. The nanostructure is intended be a cheese knife-like cutter for use on frozen cells.

The astronomers also determined that the equator of Tau Bootes rotates once every 3 days, while the star's poles rotate about 20 percent slower than that. The difference in rotation probably generates the star's magnetic field.

Astronomers would have expected the planet's orbital axis to align with the star's rotation axis. But the Catala team found that the planet moves in sync with material residing at about latitude 45° on the star's surface. This arrangement suggests that the magnetic field of the star interacts with the planet in a complex fashion.

Catala and his colleagues describe their findings online and in an upcoming *Monthly Notices of the Royal Astronomical Society*. —R.C.

ENVIRONMENT

Pesticides mimic estrogen in shellfish

Two common water pollutants can function in shellfish as the female sex hormone estrogen does. However, new studies show different behavioral effects of those contaminants on two species.

Elliptio complanata is a freshwater mussel whose populations are seriously declining in the United States. Katherine Flynn of Adelphi University in Garden City, N.Y., and her colleagues exposed lab-kept mussels to the weed killer atrazine or to estrogen for a week. Atrazine has exhibited estrogenic effects in other species (*SN: 11/2/02, p. 275*).

At an atrazine concentration of 15 parts per billion (ppb), a value permitted in U.S. waters by the Environmental Protection Agency, the mussels were 30 percent less likely to burrow than were mussels kept

in clean water. Atrazine doses far higher and lower didn't impair this defensive behavior, the researchers reported in Montreal at the Society of Environmental Toxicology and Chemistry meeting in November. The animals had the same response when the exposed to low concentrations of true estrogen.

Flynn's coworker, Josephine A. Bonventre of Rutgers University in Piscataway, N.J., observed radically different responses of the clam *Corbicula fluminea* to estrogen and another estrogenlike pollutant.

She exposed this invasive species for 1 day to between 0.1 and 15 ppb of bifenthrin, an insecticide (*SN: 2/4/06, p. 74*). Clams receiving the highest bifenthrin dose produced 46 percent more of the protein vitellogenin than did clams in water without insecticides. Animals normally produce vitellogenin only in response to estrogen. However, no dose of bifenthrin or exposure to true estrogen deterred this species from burrowing.

"Maybe that contributes to its success as an invasive species," Flynn says. If these clams are immune to bifenthrin's behavior-disrupting effects, more of the clams can burrow and avoid predators, she notes. —J.R.

ANTHROPOLOGY

South African find gets younger

The partial skeleton of a human ancestor previously found in South Africa dates to about 2.2 million years ago, roughly 1 million years younger than the original estimates, a new study finds.

Researchers had hoped that the australopithecine fossil would shed light on the transition to an upright stance and tool use between 4 million and 3 million years ago. However, the ancient skeleton is too young to address those issues, say geologist Joanne Walker of the University of Leeds in England and her coworkers.

Their findings appear in the Dec. 8 *Science*.

In 1995, another investigator noticed foot bones of the australopithecine in a box holding various fossils recovered in the 1970s at Sterkfontein cave, just north of Johannesburg. After nicknaming the find Little Foot, scientists found additional bones from the same individual in other boxes and in further excavations.

Walker's group dated Sterkfontein mineral deposits situated just above and below the fossil remains. They used a method that considered the accumulation of a specific form of lead from the radioactive decay of

uranium. This technique is more accurate than the methods used in initial estimates of Little Foot's age, the researchers hold. —B.B.

ANTHROPOLOGY

Neandertals' tough Stone Age lives

Neandertals that 43,000 years ago inhabited what's now northern Spain faced periodic food shortages and possibly resorted to cannibalism to survive, according to a new investigation.

These Neandertals evolved shorter, broader faces with a less pronounced slope than northern European Neandertals did, say Antonio Rosas of the National Museum of Natural Sciences in Madrid and his colleagues.

Since 2000, the researchers have recovered more than 1,300 Neandertal bones and teeth from an underground-cave system known as El Sidrón. The fossils come from at least eight

individuals, including one infant, one child, two adolescents, and four young adults.

Close examination of the ancient teeth revealed disturbances of enamel formation, especially in the children and teens, that Rosas and his coworkers attribute to near starvation. The team reports its results online for an upcoming *Proceedings of the National Academy of Sciences*. Furthermore, skulls and limb bones at El Sidrón display cut marks suggestive of butchering and show crushed areas, presumably where brains and marrow were removed during cannibalism, the scientists say.

In another analysis, they compared three Neandertal jaws from the site with jaws from 32 Neandertals and 23 modern *Homo sapiens* previously found at Stone Age sites throughout Europe and western Asia. Reconstructions of the lower faces indicate that Neandertals evolved into northern and southern varieties, the team claims. —B.B.

BIOCHEMISTRY

Happy fish?

Researchers have detected antidepressant drugs in the brains of fish captured downstream of sewage-treatment plants.

Pharmaceuticals taint waterways because people excrete many of the drugs they take but treatment plants don't extract all the chemicals (*SN*: 4/1/00, p. 212). Concerned that antidepressants might be accumulating in fish, Melissa M. Schultz of the College of Wooster (Ohio), and Edward T. Furlong of the U.S. Geological Survey in Denver measured concentrations of several such medicines in river water and fish in Colorado. They tested for drugs including sertraline (Zoloft), fluoxetine (Prozac), and venlafaxine (Effexor).

Sertraline and fluoxetine, two of the most widely prescribed antidepressants, showed up downstream of sewage-treatment plants but only in low parts-per-trillion concentrations. To the researchers' surprise, they found several less commonly prescribed antidepressants in significantly higher concentrations. For instance, venlafaxine reached concentrations as high as 1.4 parts per billion (ppb).

On the other hand, the higher-concentration waterborne antidepressants, such as venlafaxine, didn't show up in fish, whereas sertraline and fluoxetine did—in concentrations up to 2.5 ppb in brain tissue. The chemists reported their findings last month in Montreal at the Society of Environmental Toxicology and Chemistry meeting.

The results were "certainly counterintuitive," Furlong says. He adds that the team will now study why only some of these drugs appear to be getting into fish.

One concern, Schultz says, is that because these drugs target similar signaling compounds in the brain, their effects might be additive. —J.R.

BIOLOGY

Stem cells from bone marrow make new fat

Some body fat comes from stem cells that migrate out of bone marrow, a new study suggests.

Bone marrow acts as one of the body's most prolific stem cell factories, pumping out cells that circulate to different parts of the body through the bloodstream. Once these cells reach their destination, they can morph into new cell types—ranging from blood to heart muscle—that fill a specific need or replace cells lost to wear and tear.

Previous research had shown that certain bone marrow cells can be coaxed into becoming fat cells in the lab. However, it's

been unclear whether these stem cells naturally contribute to new fat in the body.

To investigate this question, Dwight Klemm of the University of Colorado Health Sciences Center in Denver and his colleagues worked with mice treated so that their bone marrow cells glowed green. Some of the mice ate normal, lean laboratory chow. Other mice ate chow supplemented with a drug that increases the bone marrow's output of stem cells. A third group ate high-fat diets geared to pack on weight.

Klemm's team reports in the December *Journal of Clinical Investigation* that fat deposits sampled from all three groups of mice were speckled with green fat cells, indicating that they came from bone marrow. Fat in the drug-supplemented animals and those on the high-fat diets showed significantly more of the glowing cells. —C.B.

BIOMEDICINE

Express delivery for cancer drugs

A new drug-delivery method has dramatically reduced tumors in experiments conducted with mice.

Bert Vogelstein and his colleagues at the Johns Hopkins cancer center in Baltimore injected mice with microscopic containers, called liposomes, loaded with the anti-cancer drug doxorubicin. The blood vessels in and around tumors tend to have larger-than-normal pores, so the liposomes pass into and accumulate in cancerous tissues more readily than they do in healthy ones. The liposomes eventually rupture, releasing the drug.

At the same time, the scientists injected the mice with spores of the modified bacterium *Clostridium novyi-NT*, which comes to life only in environments depleted of oxygen. Because tumors grow faster than their blood supply, their centers usually lack oxygen. Researchers had noted that the bacterium releases a protein that breaks down the membranes of red blood cells. The Johns Hopkins team decided to combine the therapies, predicting that the protein would penetrate the liposomes and make them deliver their load of drug more efficiently.

The strategy succeeded: Human-colon tumors vanished in mice receiving the combination treatment, but the cancer continued growing in animals getting either treatment alone, the researchers report in the Nov. 24 *Science*.

"It's worked remarkably well compared to other therapies, melting away very large tumors," says Kenneth W. Kinzler, an author of the new report.

He and his coauthors caution that the method has a long way to go before it can be used in people. —J.J.R.



CAVE FINDS A block of sand and clay from El Sidrón cave in Spain holds Neandertal foot bones (left) and ribs and a backbone (right).

Books

A selection of new and notable books of scientific interest

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FREEMAN DYSON

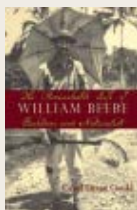
In this volume, Dyson, a renowned physicist and writer, presents a collection of his book reviews and essays on a range of scientific and social topics. Most of the 29 texts were originally published in the *New York Review of Books*. The author details how science in both Western and Eastern cultures has always been a form of rebellion against prevailing attitudes. Other essays explore whether science can be ethical and consider such topics as nanotechnology, pacifism, amateur astronomers, and Isaac Newton. Finally, Dyson ponders the connection between religion and quantum physics and the possibility of paranormal phenomena. *New York Review of Books*, 2006, 360 p., hardcover, \$27.95.



THE REMARKABLE LIFE OF EXPLORER AND NATURALIST WILLIAM BEEBE

CAROL GRANT GOULD

If Indiana Jones had been a naturalist rather than an archaeologist, he might have been named William Beebe. A socialite and celebrity, Beebe was also one of the foremost scientists of the early 20th century. Before him, naturalists were catalogers of species, usually examined when dead. Beebe changed that by studying live animals and considering their behaviors and habitats. He pioneered the technique of examining everything—plants, animals, soil, trees, rocks—within a delimited area to understand how ecosystems worked. Best known for being the first person to dive to 2,000 feet under the ocean in a bathysphere, he also wrote two dozen best-selling books on his wildlife studies in Trinidad, the Galápagos Islands, British Guiana, the Himalayas, and many other places. Gould, a science writer, was the first biographer given access to the journals and correspondence of Beebe from 1887 until his death in 1962. *Shearwater Books*, 2006, 358 p., b&w photos, illus., paperback, \$19.95.

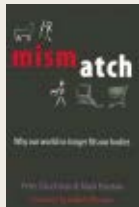


MISMATCH: Why Our World No Longer Fits Our Bodies

PETER GLUCKMAN AND MARK HANSON

People have adapted to life in virtually every environment on Earth, even the low-oxygen altitudes of the Himalayas. However, developmental scientists Gluckman and Hanson suggest that people are currently altering the environment faster than they can adapt to it. What results are imbalances that lead to problems such as obesity, diabetes, and other illnesses, say the authors. They explain how environmental influences shape human traits and discuss how those traits are passed along both biologically and culturally. People are uniquely able to alter their

surroundings and behavior to cope with changing conditions, the authors write. They show how people have affected environments through agriculture, sanitation, and transportation. Finally, the authors demonstrate how many of these created environments aren't a good match for people, who are constrained by their genetic legacies. For instance, children now mature physically before they do psychosocially, and modern diets and lowered energy expenditure leave us susceptible to obesity and other problems. The authors propose some solutions to such mismatches. *Oxford*, 2006, 285 p., hardcover, \$29.95.



FREEDOM AND NEUROBIOLOGY: Reflections on Free Will, Language, and Political Power

JOHN R. SEARLE

The fundamental issues addressed by philosophy have changed little since the beginning of history. However, considerations of consciousness, rationality, free will, politics, and ethics must now allow for the wealth of knowledge that philosophers and scientists have gained about the world and about their own biology. In two essays, Searle discusses free will in the context of neurobiology and applies his views to the notions of political power. In his first essay, he rejects attempts to deny free will and to explain the experience of consciousness as a side effect of brain states. He then looks at how the conscious experience of free will shapes the brain's structure. In his second essay, the author looks at how free will shapes society. He explains how objects convey status to their acquirers through collective attitudes, as expressed by language, and how free will is then exercised within the rules of a society. *Columbia*, 2007, 113 p., hardcover, \$24.50.



TIME TRAVELER: A Scientist's Personal Mission to Make Time Travel a Reality

RONALD L. MALLETT

What began for Mallett as a boyhood dream to reunite with his deceased father evolved into a life-long quest to build a time machine. Propelled by this mission, Mallett rose above his working-class roots to become one of the first African Americans to earn a Ph.D. degree in theoretical physics. Here, Mallett tells his story. He describes studying electronics in the U.S. military and remaining on base to avoid the palpable racism of Biloxi, Miss. During the lonely hours, he devoured books about quantum physics, philosophy, and mathematics. He later enrolled in a physics program at Penn State University. He recounts how, after a brief stint as an industrial physicist, he returned to academia and teaching at the graduate level. Mallett recalls bouts of depression that would leave him wondering whether his life's pursuits were based on fantasy. Yet his life-long dream continues to inspire his theorizing about time travel. *Thunder Mouth Press*, 2006, 216 p., b&w photos, hardcover, \$24.95.



LETTERS

Familiar pattern

I am a retired high school mathematics teacher who has quilted mathematical ideas for over 20 years. Currently, I am working on a quilt called Pascal's Pumpkin. I was totally excited by "Swirling Seas, Crystal Balls: Spirals of triangles crinkle into intricate structures" (*SN*: 10/21/06, p. 266) and began to think about quilting some spidrons! **ELAINE ELLISON, WEST LAFAYETTE, IND.**

Check the record

The research showing that experimental animals receiving both antibiotics and stomach-acid suppressants colonized large numbers of drug-resistant intestinal bacteria ("Do acid blockers let microbes reach the colon?" *SN*: 10/21/06, p. 269) might be important to preventing drug-resistant *Clostridium difficile*. Reviewing patients' records to see whether those who developed the disease were more frequently prescribed antibiotics and stomach-acid blockers at the same time might be helpful in preventing this serious problem for patients in hospitals and nursing homes.

BARBARA MCELGUNN, TORONTO, ONTARIO

They're at it again

An entire scientific community could be wrong about something, be expected to know that they are wrong, and for nearly inexplicable reasons persist in being wrong ("Fit to Be Tied: Impatience with string theory boils over," *SN*: 10/21/06, p. 264). This happened when the medical establishment embraced Freudian psychology as an explanation of human behavior. In spite of extensive training in the biological and chemical sciences, medical practitioners of Freudian psychoanalysis ignored the basic principle that any scientific explanation of natural phenomena, including human behavior, must be testable. Perhaps physicist-author Lee Smolin is right in suggesting we are witnessing groupthink, again.

BILL VAN SICKLE, MILFORD, OHIO

Collision course?

"Assault on Andromeda: Nearby galaxy had recent collision" (*SN*: 10/21/06, p. 261) states, "Several billion years from now, scientists predict, the galaxy and the Milky Way will collide...." How can galactic collisions occur in an expanding universe, where galaxies should be moving away from each other? **JAMES HENDRY, FLORISSANT, MO.**

On the large scale, objects are indeed receding from each other. But locally, the gravity of two large galaxies that are relatively near overcomes cosmic expansion. —R. COWEN

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New QuietComfort® 3 headphones represent the latest achievement. They rest on your ears rather than surrounding them. And while they are smaller than our highly acclaimed QuietComfort 2 headphones, there is no compromise in noise reduction, sound quality or comfortable fit. So now you have a choice: QC™2 headphones for around-ear use, and new QC3 headphones if you prefer a smaller, on-ear alternative.



QC2 headphones (left).
New QC3 headphones (right).

The challenge of reducing size. With conventional technology, smaller earcups compromise performance. So we launched a research project to explore whether it was possible to overcome the performance limitations of smaller size and on-ear design. The result is our new QC3 headphones that match the noise reduction and audio quality benefits of our award-winning QC2 headphones.

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