SCIENCE NEWS
THE WEEKLY NEWSMAGAZINE OF SCIENCE

OCTOBER 14, 2006 PAGES 241-256 VOL. 170, NO. 16

heat healing
pacific's bald spot
ban benefits bartenders
goats' ancient trek

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# echoes of a strange star

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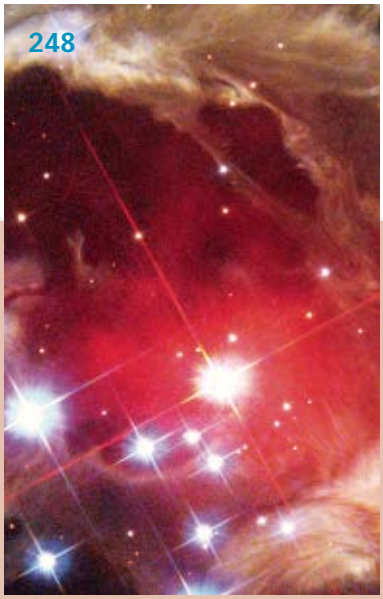


## Features



## This Week





## Of Note



## Meetings



## Departments



**Cover** Astronomers don't know why a Milky Way star called V838 Monocerotis suddenly swelled dramatically. It might have swallowed a few planets, triggered an unprecedented thermonuclear explosion, or collided with a companion star. Solving the riddle might shed new light on the evolution of stars. (NASA, ESA, Hubble Heritage Team) Page 248



**Science News** (ISSN 0036-8423) is published weekly on Saturday, except the last week in December, for $54.50 for 1 year or $98.00 for 2 years (foreign postage is $18.00 additional per year) by Science Service, 1719 N Street, N.W., Washington, DC 20036. Preferred periodicals postage paid at Washington, D.C., and an additional mailing office.

**POSTMASTER** Send address changes to **Science News**, P.O. Box 1925, Marion, OH 43306. Two to four weeks' notice is required. Old and new addresses, including zip codes, must be provided.

Printed in U.S.A. on recycled paper.


**EDITORIAL, BUSINESS, AND ADVERTISING OFFICES** 1719 N St. N.W., Washington, D.C. 20036
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**LETTERS** editors@sciencenews.org

**SUBSCRIPTION DEPARTMENT** P.O. Box 1925, Marion, OH 43306. For new subscriptions and customer service, call 1-800-552-4412.

**Science News** (www.sciencenews.org) is published by Science Service, a nonprofit corporation founded in 1921. The mission of Science Service is to advance the understanding and appreciation of science through publications and educational programs. Visit Science Service at www.sciserv.org.

# Smoke Out

## Bartenders' lungs appreciate ban

THE SMOKE CLEARS Cigarette smoke is now just a hazy memory in many bars.

ISTOCKPHOTO

**Pub workers in Scotland breathed easier** and showed better respiratory health shortly after a nationwide ban on smoking inside public places went into effect earlier this year, scientists report.

Other research had suggested that worker health improves after a smoking ban, but this is the most comprehensive study to date, says pulmonologist Daniel Menzies of the University of Dundee.

He and his colleagues identified 90 nonsmoking workers at 41 randomly chosen bars in Dundee and Perth. The researchers met each participant 1 month before the ban on smoking began in late March. The volunteers submitted to breathing tests, blood sampling, and health interviews. The researchers repeated the exams 1 month and 2 months after the ban took effect.

Before the ban, 61 of the 90 bar workers reported wheezing, shortness of breath, eye irritation, a running nose, or more than one of these symptoms. One month after the ban took effect, only 41 had such symptoms, and that number decreased slightly more in the next month, the researchers report in the Oct. 11 *Journal of the American Medical Association*.

In a standard lung-function test in which a person forcibly blows into a tube, the bar workers could exhale more air by 1 month after the smoking ban than they could beforehand. The quick turnaround is notable because these people had worked at the pubs for 9 years on average, Menzies says.

Two other tests measured inflammation in the workers' bodies. One analysis showed that the workers had, on average, fewer white blood cells in their bloodstreams 2 months after the ban took effect than they did before—a sign of reduced inflammation. Another test measured the workers' breath for nitric oxide, a gas produced by inflammation in the lungs and airways. Workers in good health showed no change after the smoking ban. But bar workers with asthma showed a 20 percent drop in expelled nitric oxide by 1 month afterward.

Previous research had established that exposure to second-hand smoke increases certain health risks (*SN: 4/5/03, p. 222*). "There's really no doubt that public policies aimed at limiting passive smoke indoors can lead to improved health," says Mark D. Eisner, a pulmonologist at the University of California, San Francisco. The new report shows that people with chronic airway diseases might benefit the most, he says.

Although some bar and restaurant owners oppose smoking restrictions, research shows that bans don't cut into their profits, says health economist Matthew C. Farrelly of the nonprofit research group RTI International in Research Triangle Park, N.C. "There's a trend [against smoking] in some states, and my guess is that trend will continue," Farrelly says.

Eisner notes that Ireland, Sweden, Norway, Italy, and New Zealand, as well as Scotland, have banned smoking in workplaces, as have nine Canadian provinces, parts of Australia, and 11 U.S. states. —N. SEPPA

# Life Blood

## Drug stops mothers' bleeding after births

**A drug sometimes used to induce abor**tions can stem bleeding after childbirth, according to a 3-year study in India. It might save the lives of millions of women in developing countries, the researchers say.

Worldwide, the leading cause of a mother's death during childbirth is postpartum hemorrhage. When the uterus fails to contract after a baby is delivered, the site where the placenta detached can bleed excessively.

In countries where babies are routinely delivered in hospitals, women who have just given birth typically receive an injection of one of several synthetic forms of the hormone oxytocin, which make the uterus contract. However, these drugs aren't often available to women in developing countries, explains epidemiologist Stacie Geller of the University of Illinois in Chicago.

"In rural areas, many women deliver in very primitive conditions," notes Geller. Their birth attendants typically aren't trained to administer injections. Even if they are, adds Geller, synthetic oxytocin needs to be refrigerated to remain stable, a luxury not available in many parts of the world.

The drug in the new study is misoprostol. Because it causes uterine contractions, it's sometimes prescribed to induce or aid abortions. Some doctors have suggested giving misoprostol, which is manufactured as a tablet, to women who don't have access to synthetic oxytocin. However, previous studies of a few hundred patients each didn't prove that misoprostol controls postpartum hemorrhage.

To investigate misoprostol's effectiveness in a larger population, Geller and her colleagues headed to rural India. There, women typically deliver their babies at home or in primitive facilities with no trained medical personnel. The researchers studied 1,620 women who gave birth between 2002 and 2005. About half of the women received a dose of misoprostol after their deliveries, and the other women received an identical-looking placebo.

Twelve percent of patients in the placebo group, compared with only 6 percent in the group taking misoprostol, had serious postpartum hemorrhage, the researchers report in the Oct. 7 *Lancet*.

"It's a pretty phenomenal result," says Geller.

Yap-Seng Chong, a researcher at the National University of Singapore who has also studied misoprostol's use in labor and delivery, agrees. "This could be the answer" for preventing many cases of postpartum hemorrhage in rural areas, he says.

Chong points out that while this study's results are promising, misoprostol sometimes causes troubling side effects, such as severe shivering and fever. However, he

notes that the benefits of the drug far outweigh the risks. "I'd rather [that a woman have a] fever and shiver than bleed to death," he says. —C. BROWNLEE

# Teasing Apart Nanotubes

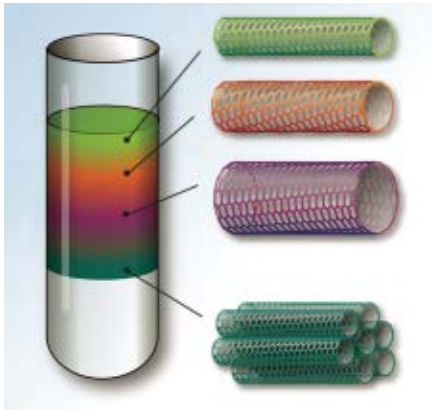
## Fast-spun carbon fibers may feed an industry

**Nanoscale tubes of carbon could potentially** lead to novel technologies, such as electronic circuits that are much faster and more compact than those made today. However, the batches of carbon nanotubes that manufacturers now produce are difficult to use because they contain a hodgepodge of tubes of varying electronic properties and diameters.

Now, researchers have devised a way to sort these nanotubes. The technique could clear a major obstacle to industrial-scale application of the tubes in circuits, sensors, computer screens, and other products, say Michael S. Arnold and his colleagues at Northwestern University in Evanston, Ill.

The new approach is "a landmark breakthrough," comments nanotechnologist and chemist Ray H. Baughman of the University of Texas at Dallas.

"This method is surely going to accelerate the process for developing real applications of nanotubes," adds chemist Jie Liu of Duke University in Durham, N.C.



**FULL SPECTRUM** Colorful bands of purified carbon nanotubes stack up in a test tube (illustrated left) after being processed by a new technique that segregates nanotubes (cylinders on right) of different diameters or electronic properties.

The atomic structures of carbon nanotubes enable some of them to serve as semiconductors in nanoscale transistors (*SN: 9/10/05, p. 165*). Other nanotubes behave like metal wires. Nanotubes' diameters also affect their properties.

In previous research, other scientists had devised ways to separate carbon nanotubes. However, those methods required costly additives or had other shortcomings that limited their potential for large-scale use, says Arnold.

In the new method, he and his colleagues, led by Mark C. Hersam, mix cheap, soaplike molecules called surfactants with a black powder containing a jumble of carbon nanotubes. The surfactants render the nanotubes water soluble. The researchers then add the blend to a test tube that they've filled so that the concentration of an iodine compound—and the density of the solution—increases with depth.

Next, they centrifuge the materials for hours at tens of thousands of revolutions per minute. Buoyancy differences segregate the nanotubes into homogeneous, horizontal bands. The nanotubes' structures cause each band to appear as a distinct color. "The first time we did this ... and saw a rainbow, we knew that it worked," Hersam recalls.

Exquisitely precise, the new technique separates nanotubes that are only a few hundredths of a nanometer different in diameter, the team reports in the October *Nature Nanotechnology*. Metallic and semiconductor nanotubes segregate because they attract different loads of surfactant molecules, the scientists speculate.

Although the team's experiments have produced only micrograms of purified nanotubes per band, a path to much larger yields is straightforward, Hersam says: Use bigger centrifuges, and lots of them. —P. WEISS

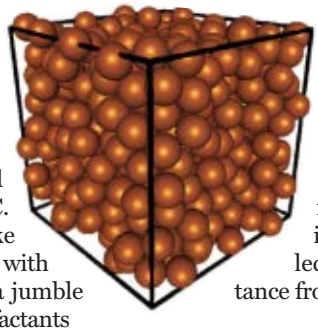
# Messiness Rules

## In high dimensions, disorder packs tightest

**Should you find yourself with a 60-dimensional** suitcase, the best way to pack it may be the easiest: Throw in everything in a jumble. That's the way to fit the most high-dimensional spheres into a fixed space, new research suggests.

The finding may be useful even to people without extra-dimensional luggage. It may improve the design of mathematical procedures called error-correcting codes used in computers to interpret noisy data.

Some 400 years ago, Johannes Kepler speculated that the best scheme for packing three-dimensional spheres is the way that grocers have always done it. Their orderly, pyramidal packing scheme piles the most oranges into the least space. Yet it took mathematicians until 1998 to prove Kepler right (*SN: 8/15/98, p. 103*).



**JUMBLE IS BEST** In three dimensions, disorderly arrangements of spheres, such as this one, are less dense than tidier arrangements. But in very high dimensions, disorderly arrangements seem denser than neat ones.

But what about higher-dimensional spheres? Although a 5- or 6- or 60-dimensional sphere may sound strange, it's mathematically simple. A sphere in any dimension is the collection of points a fixed distance from a central point.

But in high dimensions, spheres behave oddly. "Anything that can happen will happen if you're in high enough dimensions," notes sphere-packing mathematician Henry Cohn of Microsoft Research in Redmond, Wash.

As a result of this odd behavior, mathematicians haven't yet found the densest packing scheme for homogeneous groups of high-dimensional spheres. A century ago, they determined a range for the best scheme, but there have been only slight improvements since. Salvatore Torquato and Frank Stillinger, both theoretical physicists at Princeton University, now describe an approach that sharply narrows that range.

The pair suggests that in high dimensions, it's best to pack spheres in patterns that vary from spot to spot, rather than to repeat an arrangement in an orderly way. "People have intuited this might be the case," says Torquato, "but this provides the first evidence backed up by some solid math."

The argument, published in the fall *Experimental Mathematics*, relies on the assertion that certain disordered packing arrangements exist in very high dimensions. Support for that idea comes from physics rather than math. "The arguments they've got for the conjecture are nothing like a math proof, but they feel compelling," Cohn says.

The physicists bring a new approach to a mathematical problem, which ultimately may be more important than the result, Cohn adds. "Regardless of whether [the finding] is true, it injects exciting ideas into the field," he says.

Furthermore, the results may improve the design of computer equipment. Engineers use high-dimensional sphere packings to generate the error-correcting codes that electronic equipment uses for communication (*SN: 10/2/04, p. 219*).

Z. DERETSKY/NATIONAL SCIENCE FOUNDATION; TORQUATO

Torquato says that the new research suggests a much better approach to designing these codes. —J. REHMEYER

# Well Traveled

## Gene split arose early in domesticated goats

**Present-day domestic goats may look humble,** but they harbor more genetic diversity than any other livestock species. In fact, analyses of goats' mitochondrial DNA have shown that these animals evolved through five distinct maternal lines that spread from the Near East and central Asia across Europe.

A new study indicates that goats representing the earliest two of the five genetic lines inhabited the same location in southwestern Europe by about 7,000 years ago, only 3,000 years after the initial domestication of the animals in the Near East.

This ancient genetic diversity in a region far from the goat strains' origins reflects the long-distance transport of goats from the Near East by European pioneers soon after the origins of animal domestication, farming, and village life, say geneticist Pierre Taberlet of Joseph Fourier University in Grenoble, France, and his colleagues in an upcoming *Proceedings of the National Academy of Sciences*.

Today's other three genetic lines arose later in parts of central Asia, Taberlet's group proposes.

The scientists analyzed mitochondrial DNA retrieved from 19 goat bones found at an ancient farming site in southern France. Other researchers had excavated these fossils about 20 years ago in soil that contained the remains of more than 5,000 animals, including pigs, cattle, and sheep.

New radiocarbon measurements of five goat bones placed them at between 7,300 and 6,900 years old.

By extracting and analyzing genetic material from several goat bones, two independent laboratories confirmed that the sequences that Taberlet's group examined were uncontaminated, ancient DNA.

Comparisons of the ancient goat mitochondrial DNA with sequences of modern goat DNA revealed that the two Near Eastern lineages had inhabited the prehistoric French site at the same time.

Taberlet and his colleagues suspect that early farmers transported each line of goats into Europe along a separate westward route, one inland and the other running along the Mediterranean Sea.

A preference for moving goats long distances in ancient times makes sense (*SN: 5/12/01, p. 294*). Goats are the hardiest livestock species. They're easy to transport by land or boat, and they willingly follow people.

The new data convincingly show the domestication of two ancient goat lineages at the same time somewhere in the Fertile Crescent region, remarks archaeobiologist Melinda A. Zeder of the Smithsonian Institution's National Museum of Natural History in Washington, D.C.

Genetic studies of modern domestic sheep have revealed a pattern similar to that of goats, with three to four ancient lineages, Zeder notes. "This suggests that both sheep and goats moved together, as they do today, in mixed herds as they diffused out of the Near East," she says. —B. BOWER

TABERLET

**ANCIENT MOVERS** **Modern goats such as these derived from several ancient lineages, including two introduced to Europe about 7,000 years ago from the Near East.**

# Courting Costs

## Male prairie dogs seem too busy mating to dodge predators

**Mating season makes the normally fast** and tough male prairie dog so preoccupied that he's easy pickings for predators, researchers find.

In a study of prairie dogs in the wild, a fox and a few goshawks caught adult males only during the short breeding season, says John L. Hoogland of the University of Maryland Center for Environmental Science in Frostburg. In those 17 days, though, predators picked off enough adult males to account for almost 40 percent of all captures observed during a 4-month period.

Other vulnerable adult groups were pregnant females, recent immigrants, and prairie dogs with edge territories, says Hoogland.

"Perhaps our most important finding is that nonjuvenile victims of predation were not the old and the weak, but rather young and middle-aged adult Utah prairie dogs in excellent condition," he and his colleagues conclude in the October *American Naturalist*.

The study took advantage of a rare opportunity to see prairie dog predators in action, says Hoogland. The results convinced him that the presence of researchers often scares away such animals.

Since 1995, Hoogland and his crew have spent months at a time, dawn to dusk, watching a colony of a hundred or so Utah prairie dogs (*Cynomys parvidens*) in Bryce Canyon National Park. The rarest of the five prairie dog species, it has such small populations that common perils, including "varmint shootings," threaten its existence, says Hoogland.

In 2005, a fox that had gotten used to people lunched frequently at the colony. Also, at least one goshawk made unusually common strikes. In 4 months, the crew saw these predators kill 26 prairie dogs. During the entire previous decade, the team had observed only 7 such deaths.

Seeing so many kills "has forced me to rethink what I know about prairie dogs," says Hoogland. He hadn't ranked predators as a major risk before. Several lines of evidence, however, suggest that the predation tallied in 2005 was not a fluke, he says.

The problem for the adult males that predators captured "was mostly just total preoccupation with sex," says Hoogland. A female prairie dog becomes fertile for at most 5 hours once a year.

The numbers in the new prairie dog study are small, cautions Peter Neuhaus of the University of Neuchâtel in Switzerland. In his studies of Columbian ground squirrels, he, too, has seen high mortality among breeding males. Yet he couldn't tell whether predators, disease, or overexertion claimed them.

Neuhaus says that he observed predators catching his study animals, but he adds that

"the main problem" with some other long-term studies is the rarity of reported predator attacks. —S. MILIUS

# Nearly Naked

## Large swath of Pacific lacks seafloor sediment

**Oceanographers have discovered a broad,** almost-bare patch of seafloor in the remote South Pacific. An unusual combination of circumstances has left the region without the mineral and organic sediments hundreds of meters deep that are typical elsewhere in the world's oceans, the scientists say.

The sediment-poor region is about the size of the Mediterranean Sea and centered approximately 4,000 kilometers east of New Zealand. Researchers discovered the area, which they dubbed the South Pacific Bare Zone, during a cruise early last year, says David K. Rea, a marine geologist at the University of Michigan in Ann Arbor.

The scientists were surprised when their seismic equipment, which detects sediment only when it's at least 5 meters thick, indicated that there was no sediment in that region. The team then sent sampling equipment more than 4 km to the seafloor and discovered as little as 50 centimeters of sediment in some places.

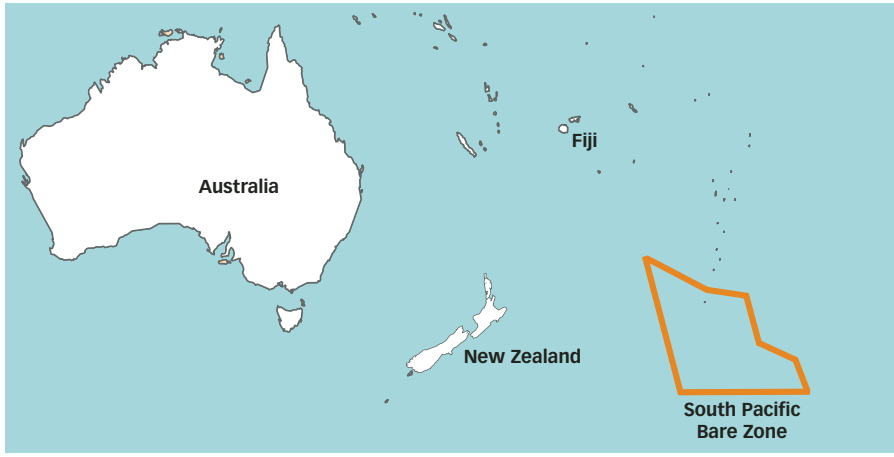
A unique combination of factors seems to have dictated the area's dearth of sediment that's accumulated since the basalt crust below formed between 85 million and 34 million years ago, Rea and his colleagues report in the October *Geology*.

First, the area has nutrient-poor surface waters and so is home to few organisms. Therefore, there aren't large quantities of plankton to die, fall to the bottom, and accumulate, as they do in seas with high biological content, says Rea.

Second, the deepest waters in this area contain less carbonate and silica than those in other locations do, so skeletons of organisms that reach the seafloor dissolve.

Third, the bare zone is far from any major landmass, so little windblown dust ends up in the surface waters and eventually sinks. Finally, the region has little if any hydrothermal activity to spew water containing dissolved minerals that would precipitate.

Rea says that he and his colleagues had expected to find at least a dozen meters of sediment in the region. "It's fun to be wrong sometimes," he notes.




**BARE FACTS** A 2-million-square-kilometer region (orange) is almost devoid of seafloor sediment.

Neil C. Mitchell, a marine geologist at Cardiff University in Wales, suggests another factor that may contribute to the sediment skimpiness of the area. It's out of the path of major ocean currents, so Antarctic icebergs carrying material scraped from that continent don't pass over the bare zone and drop sediment, says Mitchell.

The sparse sediments may permit researchers to find seafloor substances that are typically hidden, says David Scholl, a marine geologist at Stanford University. For instance, meteor dust, which falls evenly over Earth's surface, may be more easily detectable in the bare zone than elsewhere, says Scholl. —S. PERKINS

# Pretty in Pictures

## Details of molecular machinery gain Nobel

**In yeast, the enzyme that transcribes the** protein-making instructions encoded in DNA consists of roughly 30,000 atoms. Five years ago, Roger D. Kornberg published a solo portrait and an action shot of this molecular machinery in atomic detail.

Last week, Kornberg, of the Stanford University School of Medicine, was awarded the 2006 Nobel Prize in Chemistry for those images, which were the product of nearly 2 decades of research in his laboratory on the enzyme called RNA polymerase.

Working out the structure of RNA polymerase was "a marvelous achievement," says James T. Kadonaga, a biochemist at the University of California, San Diego. "It's one piece of a much larger puzzle, but an extremely important piece."

The structure of RNA polymerase intrigued Kornberg because this enzyme begins the protein-making process. It copies gene sequences from DNA to create a single-stranded nucleic acid called messenger RNA. Other parts of the cell then use the messenger RNA to direct protein assembly.

To determine the enzyme's structure, Kornberg and his colleagues used RNA polymerase from yeast cells. One of the many challenges in their work, says Kornberg, was developing the procedures to grow sufficient quantities of pure, three-dimensional crystals of RNA polymerase, which is a complex of 12 proteins.

Advances in X-ray crystallography, which the team used to image the enzyme, were also critical. In this technique, a sample scatters X rays that researchers had focused on it. From characteristics of the scatter, a computer creates an image showing the positions of the structure's atoms.

The work of Kornberg's team culminated in 2001 with two publications, one showing inactive RNA polymerase and the other capturing the machinery during the transcription process. The latter image shows how RNA polymerase grasps DNA and how the enzyme chooses the correct building blocks for the messenger RNA. It's a picture that "I regard as one of the most indelible of our work," says Kornberg.

Jeremy M. Berg, director of the National Institute of General Medical Sciences in Bethesda, Md., says, "If you understand the structure and the mechanism of how RNA polymerase works, it will help you understand gene regulation," which in turn is "hugely important" to studies of disease.

The work by Kornberg and others has provided "significant" insights, says Richard H. Ebright of Rutgers University in Piscataway, N.J. He adds, "Most people in our field imagined [a Nobel prize on transcription] would be shared."

"Transcription is a very large field," says Kadonaga. "While I'm really happy for Roger [Kornberg], I also hope there is a place for other people, like Robert Roeder" of Rockefeller University in New York City, who discovered that there are multiple forms of RNA polymerase. "They are very deserving," Kadonaga says. —A. CUNNINGHAM

E. ROELL

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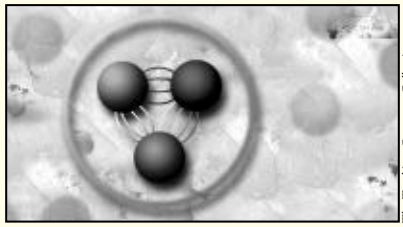

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Model of protons showing quarks

### About Your Professor

Dr. Steven Pollock (Ph.D., Stanford University) is Associate Professor of Physics at the University of Colorado at Boulder. He has taught physics courses from introductory physics to advanced nuclear and particle physics. He received the Boulder Faculty Assembly Teaching Excellence Award in 1998. He became a Pew/Carnegie National Teaching Scholar in 2001. He is the author of *Thinkwell's Physics I*, a CD-based textbook.

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# ENIGMATIC ERUPTION

## The strange case of V838 Monocerotis

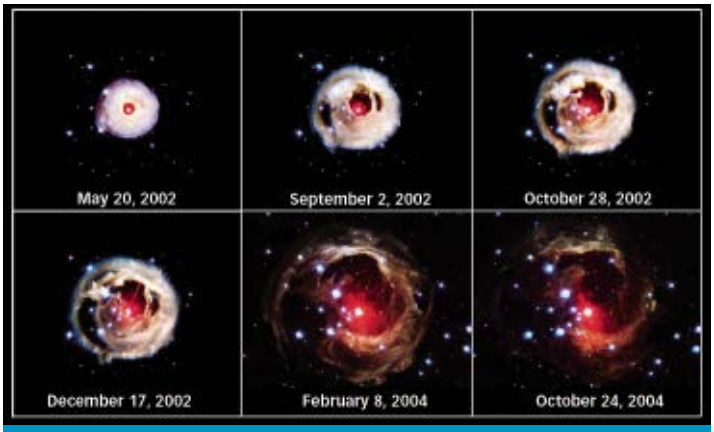
BY RON COWEN

An erupting star near the outskirts of the Milky Way has become one of the most puzzling objects in the galaxy. The star's outburst has set aglow a never-before-seen array of dust eddies, shells, and spirals—a cosmic portrait reminiscent of the whirling patterns of Van Gogh's "Starry Night." But even as astronomers marvel at the artistic display generated by the distant star, dubbed V838 Monocerotis, they're stumped by its behavior.

"We've never seen anything like this," says Howard Bond of the Space Telescope Science Institute in Baltimore.

Although the erupting star briefly became one of the brightest stars in the galaxy, it has now dimmed and become one of the coolest. Moreover, instead of hurling into space its outer layers of material, as happens in a common type of stellar explosion, the star swelled to a gargantuan diameter as large as the average distance between the sun and Saturn.

Theorists have come up with several explanations for the star's extraordinary behavior: a thermonuclear explosion on the star's surface, a collision with an unseen companion, the swallowing of one or more closely orbiting planets. But none of these models fits exactly the fireworks observed. As astronomers work to solve the puzzle of V838 Monocerotis, they're applying their breadth of knowledge about the evolution of stars, and they're confronting what they still don't understand about stars and how they erupt.




**STELLAR ECHO —** Sequence of Hubble Space Telescope images shows the expansion of the light echo (white) around the star V838 Monocerotis from May 2002 through October 2004. The amount of scattered light declines as it propagates into the dust surrounding the star.

NASA, ESA, HUBBLE HERITAGE TEAM

**PUZZLING PORTRAIT** Few astronomers paid much attention in January 2002 when amateur astronomer Nicholas J. Brown of Quinns Rocks, Australia discovered V838 Monocerotis as a brightening star. Within days, the star faded, fitting the pattern of a common type of outburst—called nova from the Latin word for "new star"—that astronomers had documented many times before.

Novas occur when a white dwarf—the dense cinder of a sunlike star—steals matter from a puffier companion star. When the material piling onto the surface of the white dwarf reaches a critical density, it sparks a thermonuclear explosion. The outburst is observed as a jump in brightness over a wide range of wavelengths. Novas can recur as often as every few years as the dwarf accumulates additional material from its partner.

Astronomer Sumner Starrfield of Arizona State University in Tempe says the nova detected by Brown seemed typical. "I don't think anyone was doing anything extraordinary to follow it" because it seemed so run-of-the-mill, Starrfield says.

But just a month after its discovery, the blue-tinged star had a sudden resurgence. It grew about 30 times brighter in a single day, outshining nearly every other star in the Milky Way. After fading in mid-February 2002, it bloomed a third and final time in March of that year, ballooning to 500 times its original width before slowly fading. It also dropped in temperature from 6,000 kelvins, slightly hotter than the sun's visible surface, to 2,000 K and took on a reddish hue.

That's in striking contrast to a classic nova in which a star's outer layers, cast off during an explosion, gradually expand and thin to reveal the blue, still-hot white dwarf that remains behind. The dwarf emits X rays and ultraviolet radiation, neither of which was detected from V838 Monocerotis.

This erupting star "does not resemble any nova that has been studied," says Starrfield. By monitoring the intensity of individual wavelengths of the infrared light from the outburst, astronomers have determined that V838 Monocerotis is a binary star system. It consists of a blue supergiant star and a cool star. The supergiant is just a bystander, the cool star is the one that ballooned so dramatically.

V838 Monocerotis is "the prototype of a new class of star," assert Israeli astrophysicist Alon Retter and his colleagues in a recent review article. Retter, Bond, and several other astronomers described their theories and observations of V838 Monocerotis at a conference in La Palma, Spain, in May and have recently posted the reviews online (*www.sciencenews.org/articles/20061014/bob9ref.asp*).

**MYRIAD MODELS** Astronomers have come up with several theories to explain the bizarre properties of V838 Monocerotis. Retter and his colleagues have suggested that the ballooning star engulfed a trio of unseen planets in rapid succession. Each of the three peaks in the star's outbursts might have corresponded to the consumption of a planet, Retter says. He and his team calculate that the energy unleashed by planet swallowing—the point when the planet's gravitational energy is absorbed by the parent star—would account for the observed brightening of the star.

Each planet would have to have been a so-called hot Jupiter, a body as massive as our solar system's giant planet but that circles the star at only about a tenth of the distance between Mercury and the sun.

Astronomers have discovered more than two dozen such planets closely orbiting other stars over the past decade, although they don't know whether any planet circles V838 Monocerotis.

In the mid-August *Monthly Notices of the Royal Astronomical Society*, Retter and his colleagues argue that the consumption of even a single hot Jupiter could account for the multistage outburst. In this scenario, a lone Jupiter-mass planet halts three times as it plummets into the inflating star, unleashing energy during each stop. The incoming orb finally comes to rest about a solar radius from the star's core.

The planet-gorging model is also one way to account for the lithium that researchers have observed in the star. Lithium can barely be detected in most stars because it mixes readily into a star's core, where nuclear reactions destroy it. A freshly digested planet rich in lithium would temporarily boost a star's surface abundance of the element.

But stars as young as V838 Monocerotis haven't had a chance to mix lithium into their cores and would have high concentrations of the element at their surfaces even without invoking planet swallowing, notes Mark Rushton of Keele University in England.

Rushton, Starrfield, and several other researchers contend that planet swallowing doesn't provide enough energy to power the eruption of V838 Monocerotis. "I'm very skeptical [because] the energetics are all wrong," says Starrfield. "I've been telling this to Alon [Retter] for 3 years, and we've never convinced each other."

"In principle, a collision of a ... star with a planet can lead to [an outburst], but not as bright as that of V838 Monocerotis," assert Noam Soker of the Technion University in Haifa, Israel, and Romuald Tylenda of the Copernicus Astronomical Center in Torun, Poland, in a review article recently posted online (*http://xxx.lanl.gov/abs/astro-ph/0606371*).

According to Soker and Tylenda, a stellar crash is a more promising model. They propose that a low-mass star, one-tenth to one-third the mass of the sun, collided and merged with V838 Monocerotis, generating the fireworks. A third star might have been part of this fragile stellar partnership and might have been ejected during the merger. By getting kicked out of the system, this third star could have brought the two colliding stars together.

An analysis of such a collision suggests that the merger would rapidly produce a red, puffy star, as required for the V838 Monocerotis outburst, Soker and Tylenda argue. The researchers describe this latest work in the May *Astronomy & Astrophysics*.

"All models I know of to explain V838 Monocerotis, beside the stellar-merger model, were invented after the eruption and had to be twisted to fit some of the properties," says Soker. Retter counters that the energy produced by a collision with a low-mass star isn't much greater than that generated when a heavy planet is swallowed.

But Starrfield says that he worries that just as planet dining might produce too little energy, a stellar collision might produce too much. He suggests yet another theory—that the outburst might be the result of an unusual nova, in which a thermonuclear explosion is triggered on the surface of a cool star—a white dwarf—rather than a hot, blue star. The explosion would then merely be the most recent among a string of cosmic bombs that the star has detonated over the past few thousand years. But exactly how cool stars might spark these explosions remains unclear.

BOND, NASA, ESA

**NEW PORTRAIT —** In this latest image of the wispy light echo of the star V838 Monocerotis (arrow), taken Sept. 9 by the Hubble Space Telescope, several new features have emerged. These include the vortex pattern in the upper-left portion of the echo and the band of light running through the star. The latter feature suggests that the illuminated dust was ejected by the star during previous eruptions.

**A DUSTY RESOLUTION?** About 2 months after V838 Monocerotis' discovery, astronomers awoke to the artistic side of the odd star: It had begun to show light echoes. Similar to the sound of a hand clap reverberating from the walls of an empty ballroom, flashes of light from the star's outburst scattered off clumps of surrounding dust, setting them aglow like a string of lightbulbs that switch on sequentially. The light echoes create the illusion of a halo of dust expanding faster than light, but the dust isn't actually moving. The light simply brings different parts of the dust clouds into view at different times.

In April 2002, the Hubble Space Telescope got into the act. Astronauts had installed a new detector on Hubble, the Advanced Camera for Surveys, with twice as large a field of view as Hubble's previous workhorse instrument had and about double its sensitivity.

Soon after the light echoes were discovered, a team including Bond and Starrfield asked for time with the new camera to capture several images of V838 Monocerotis. Some people consider those images among the most stunning that Hubble has ever recorded. The pictures, as well as ones recorded as recently as last month, may shed light on the true nature of the stellar outbursts.

It all depends on whether the illuminated dust came from previous outbursts of the star or was already there as part of the interstellar medium. By observing the light echoes, astronomers plan to develop a three-dimensional map of the dust and determine the origin of the material, notes Bond. That, in turn, may provide a clue about which of the outburst models is correct. The nova model, for instance, predicts that much of the dust was expelled by the star in a series of thermonuclear explosions.

The amount of dust in the echoing region provides another way to discriminate between the models. If the dust is more than 10 times as great as the mass of the sun, it couldn't have come from a young star, says Soker. Preliminary estimates suggest that the region contains 100 to 1,000 solar masses of material, he says.

Measurements of the star's spin, as well as determinations of whether V838 Monocerotis sports a dusty disk, could make or break the stellar-merger model. In that scenario, the collision induces high angular momentum in V838 Monocerotis. Like the proverbial ice skater who pulls in her arms to speed her spin, the star rotates faster as it contracts. Evidence for such fast rotation would support the merger scenario, notes Soker. The high spin rate created by the merger would also produce a dense, dusty disk rapidly rotating around the star. This disk might be revealed as the star shrinks.

Another way to distinguish among the models may be to determine whether the star has a close, surviving companion. The nova theory predicts that the star has a partner star from which it siphons material. In contrast, the merger model predicts that a close companion couldn't have survived the 2002 eruption. It would have been destroyed during the collision.

Some of the developments that would indicate the origin of the fireworks from V838 Monocerotis are still several years in the future. In the meantime, astronomers have some beautiful pictures adorning their walls—and an intriguing stellar mystery. ■

# WARMING UP TO HYPERTHERMIA

## Heat therapy could improve existing cancer treatments

BY CHRISTEN BROWNLEE

In March 1999, Jason Foster was unpleasantly surprised by a BB-size lump that he found in one of his testicles. He ignored it for a week, hoping that it would go away. But instead, the lump swelled to the size of a pea. "I had alarm bells going off in my brain," recalls Foster. A trip to the urologist confirmed his fears—Foster had testicular cancer. The news set him on a grueling, 4-month path of surgery and multiple chemotherapy drugs. Foster lost his hair, spent hours throwing up, and was exhausted. To stay upbeat, he tried to keep the disease in perspective.

"I knew I'd have a positive outcome on the other side," says the 36-year-old media-relations director at San Diego State University. "I still think of myself as having had minor league cancer. Those with breast, lung, and other cancers, they go through treatment, and there's no guarantee that they'll make it."

Foster's take is correct: Among cancers, testicular cancer is unusually curable. Even when the cancer has migrated elsewhere in the body by the time of diagnosis, about 72 percent of men are still alive 5 years later. In contrast, the 5-year survival rate for breast cancer is about 26 percent after it spreads.

Researchers have puzzled for years over what they call the "Lance Armstrong effect," named after the world's most famous bicycle racer and testicular cancer survivor. Some scientists propose that a single factor—heat—could be responsible for this cancer's relatively easy cure. Testicular cells normally stay a couple of degrees cooler than other cells in the body. The cooler cells can't survive normal body temperatures, and researchers speculate that they retain this vulnerability even when they become cancerous and spread to other parts of the body.

"The hypothesis is that that slight temperature change is enough to put them on the cliff's edge, so just a slight nudge from chemotherapy or radiation makes them die when they wouldn't die otherwise," says Theodore DeWeese, a radiation oncologist at Johns Hopkins University.

**VICTORY —** Cyclist and testicular cancer survivor Lance Armstrong gets a medical checkup during the 2004 Tour de France. Applying heat might make other cancers as easy to eliminate as testicular cancer, which is foiled by body temperature and so seldom kills.

© DAMIEN MEYER/DPA POOL/EPA/CORBIS

Researchers have applied this principle to other types of cancers. By simply ratcheting up a tumor's temperature a few degrees—similar to the tiny temperature difference between the testes and the rest of a man's body—scientists are boosting the power of radiation, chemotherapy, and cancer vaccines. Armed with a better understanding of how heat amplifies those treatments' effects and with new tools to heat tumors, researchers may someday give every cancer patient the bright prognosis of Foster, Armstrong, and other testicular cancer survivors.

**HEATING UP** The idea of prescribing heat, or hyperthermia, to cure whatever ails you spans hundreds of years, says cancer researcher Donald Coffey of Johns Hopkins University in Baltimore. "There's no culture in the world that doesn't believe that hot springs and baths are good for you," he adds.

In the late 1800s, a New York bone surgeon named William Coley discovered that cancer patients who came down with infections—and fevers as a consequence—sometimes experienced remissions. He achieved similar results by injecting patients with bits of bacterial cell walls, which prompted fevers without infections' other dangers.

Almost a century later, in the 1970s and 1980s, researchers renewed attempts to kill tumors by heating them with microwaves, ultrasound, or other methods. "We had our sights set on killing tumor cells directly to make hyperthermia effective," says radiation biologist Mark Dewhirst of Duke University Medical Center in Durham, N.C.

As researchers developed more-accurate ways to measure internal temperature, they made a surprising discovery. "We found out that temperatures too low to kill cells were quite effective in sensitizing tumors" to other treatments, Dewhirst says. Temperatures that were a mere 2°C to 9°C warmer than body temperature could make a difference for cancer treatments.

It's not clear how higher temperatures sensitize cells. One possibility is that heating improves a tumor's blood flow, delivering more chemotherapy drugs to cancer cells. Better blood flow also delivers more oxygen, a pivotal ingredient in making radiation treatments effective.

Heat also deforms the vast array of proteins necessary for normal cellular functions, explains radiologist Joseph Roti Roti of

Washington University in St. Louis. Some proteins bend when warmed, exposing molecular segments that stick to other proteins. "This is like putting rust in the machinery," he says.

Hotter temperatures also seem to have a dramatic effect on the immune system, says immunologist Elizabeth Repasky of Roswell Park Cancer Institute in Buffalo, N.Y. Studies in her lab and elsewhere' have shown that fever-range temperatures increase the infection-fighting ferocity of immune components such as dendritic cells and macrophages. Such an increase in immune power could also potentially fight off tumors, Repasky says.

However, some researchers suggest that the most convincing explanation for hyperthermia's effects is that the cellular nuclear matrix is damaged by heat. The structure, which stretches like a spider web throughout each cell's nucleus, is pivotal for DNA replication and the first step in translating genetic information into the proteins that a cell needs to function. Although cancerous testicular cells survive higher temperatures than healthy testicular cells can, normal body temperatures damage the nuclear matrices of both types of cells, says DeWeese. The added damage from radiation or chemotherapy kills the cancerous cells.

Heat also damages the nuclear matrices in other cells, DeWeese adds, though it takes a higher temperature than that of the body.

"The challenge is, what is that deadly temperature for prostate cancer or breast or lung cancer?" asks DeWeese.

**SIZZLING STUDIES** Regardless of heat's mechanism, clinical trials of hyperthermia have delivered promising results.

In trials reported in the May 2005 *Journal of Clinical Oncology*, Dewhirst's team showed that heat treatment could amplify radiation's effects. The scientists recruited 109 cancer patients with superficial tumors, such as those in the skin of the head, neck, or breast. Half the patients received radiation alone, and the other half received radiation plus two weekly sessions of hyperthermia treatment.

After several months, the researchers found that about two-thirds of the patients in the hyperthermia group showed no lingering signs of their cancer. In contrast, only 42 percent of patients receiving just radiation had that response.

Dewhirst and his colleagues are currently juggling three other hyperthermia clinical trials: one for cervical cancer that's spreading, another for breast cancer that's recurred on the chest wall, and a third for advanced sarcoma, a cancer that arises in muscles, fat, and other soft tissues.

Dewhirst and his team usually work with the same type of microwaves that people use to heat leftovers. Penetrating only about 3 or 4 centimeters into tissue, the microwaves warm tumors in the skin, breast, chest wall or limbs, and on the cervix.

In a typical hyperthermia treatment at Dewhirst's lab, several microwave antennas are strapped to a patient's body directly over a tumor. These antennas are adjusted to direct the microwave beam. The researchers put a small catheter inside the tumor to monitor its temperature. The researchers warm the tumor to between 40° and 43°C (104° to 109°F) and keep it there for about an hour. Patients typically get this treatment once or twice a week in conjunction with radiation or chemotherapy.

Repasky is harnessing hyperthermia in a less direct way: by exploiting its effects on the immune system. She notes that several studies have suggested that cancer vaccines can tune the immune system to fight existing tumors. She and her team wondered whether heating the whole body might increase cancer vaccines' effectiveness by making the immune system a more efficient fighter.

To test the hypothesis, Repasky and her colleagues John Subject and Sherry Evans, also of Roswell Park, administer a cancer vaccine to mice with a form of breast cancer. Then once a week, the researchers place some of the mice in a warm box to raise each animal's core temperature to about 39°C, which mimics a low fever.

The researchers haven't yet published their findings from such experiments, but Repasky says that the heat seems to turn cancer vaccines into more effective weapons against the disease. "Our preliminary data suggest that this is worth moving forward on," she says.

Like Repasky, Joan Bull of the University of Texas Health Science Center in Houston is using full-body heat to treat cancer. Her team has found that warming people to feverlike temperatures seems to amplify the effects of chemotherapy.

In ongoing clinical trials, patients get one type or more types of chemotherapy. Then, a day or two after taking the drugs, each patient climbs into a bed equipped with an overhead infrared heat lamp. Once a patient reaches a core temperature of 40°C, he or she gets wrapped up "like a mummy" in blankets that maintain the temperature for about 6 hours, Bull says.

> "We found out that temperatures too low to kill cells were quite effective in sensitizing tumors."
>
> — MARK DEWHIRST, DUKE UNIVERSITY MEDICAL CENTER

In one trial of eight patients with advanced pancreatic cancer—a disease that typically kills its victims within 4 months of diagnosis—five people had at least some regression of their disease. In other clinical trials, Bull and her team are investigating timing options for hyperthermia treatments and combining it with drugs.

Coffey and his colleagues, including DeWeese and Robert Getzenberg of Johns Hopkins, are trying a more targeted approach: heating cancer cells from the inside out.

The team's efforts rely on iron nanoparticles, tiny bits of metal that are already used as contrast agents in some medical-imaging techniques. The researchers' strategy is to tag the nanoparticles with antibodies or other molecules and have the immune system guide the particles directly to cancer cells. Once the iron enters cancer cells, a magnet would heat the cells a few degrees above normal body temperature. Getzenberg and his colleagues outline their approach in the July 26 *Journal of the American Medical Association*.

The researchers recently started testing the strategy in mice implanted with human-prostate tumors.

**HOT NEW TREND?** With more and more experiments showcasing hyperthermia's potential, the National Cancer Institute (NCI) is devoting a substantial amount of grant money to the cause, says Rosemary Wong, who directs NCI's division of cancer treatment and diagnosis. Wong notes that hyperthermia could carve itself a niche in regimens for attacking some cancers that can't currently be effectively treated, such as extremely aggressive tumors and those too advanced to be surgically removed.

"If a tumor is already resistant to chemotherapy or radiation or is very advanced, then you need to try something new," she says.

However, Wong notes, hyperthermia still has far to go before it becomes a standard therapy. Researchers need to optimize the temperature range and the methods for applying heat for each type of cancer. Improved ways to measure temperature and to keep it constant could also take hyperthermia to the clinic faster.

Scientists might find ways to make heat even more devastating for cancer cells, says cancer researcher Dennis Leeper of Thomas Jefferson University's Kimmel Cancer Center in Philadelphia. When cells heat up, he explains, protective molecules called heat-shock proteins spring into action. Various interventions, such as adding drugs or changing a cell's pH, can make heat-shock proteins less efficient. This could amplify the consequences that heat has on cellular proteins, perhaps leading to hyperthermia methods that harm cancer cells at lower temperatures.

Such measures could eventually make cancer cells as easy to kill as those that plagued Foster, who this past July celebrated 7 years without a recurrence of his cancer. Regardless of heat's role in his treatment, Foster says that he feels lucky to be alive. In the future, he hopes that other cancer patients can be just as lucky. ■

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# OF NOTE

EARTH SCIENCE

## Ancient hot spell is linked to copious carbon dioxide

The presence of a particular mineral in ancient rock suggests that during an extended warm period in Earth's past, the atmosphere held at least triple the concentration of carbon dioxide that it does today, a new analysis shows.

Between 52 million and 50 million years ago, Earth's climate was the warmest it had been since the dinosaurs died out 65 million years ago. The temperature of the deepest water in the oceans, an indication of global climate, was at least 10°C higher than it is today.

**HOT TIMES** The nahcolite layers (brown) in this rock indicate that when the mineral formed about 50 million years ago, concentrations of carbon dioxide in the atmosphere were three times those found today.

Some rocks derived from Colorado lake sediments of that era contain large amounts of nahcolite, a natural form of baking soda. Lab tests indicate that nahcolite would precipitate out of salty, alkaline lakes only if atmospheric concentrations of carbon dioxide were above 1,125 parts per million (ppm), Tim K. Lowenstein and Robert V. Demicco of the State University of New York at Binghamton report in the Sept. 29 *Science*. Today, concentrations of that greenhouse gas measure about 380 ppm, Lowenstein notes.

The climate around the ancient lake where these minerals formed was probably similar to that at the Dead Sea today, says Lowenstein. There, air temperatures average 24°C and surface-water temperatures range from 21°C to 36°C. —S.P.

NEUROSCIENCE

## Right brain area linked to fairness

The ability to control selfish impulses in order to reject an unfair deal depends on a specific right brain area, a new study finds.

A team led by Daria Knoch of the University of Zurich focused on a game in which one person makes an offer to another person on how to split a pot of money. The second person can either accept the offer and pocket the offered portion, or refuse it, leaving both players with nothing. Responders typically reject offers of less than 25 percent of the pot, preferring zilch to an unfair deal.

Knoch's group studied 52 adults who fielded offers in a series of such games, each with a pot of about $16. For 36 of the participants, the researchers used a special device to deliver magnetic pulses to either the right or left side of a frontal-brain region that's thought to mediate fairness decisions. This technique temporarily halts neural activity in a targeted area.

The rest of the volunteers received a sham magnetic treatment.

Almost half of the people with disabled right brain areas accepted offers of 20 percent of the pot, compared with about a tenth of people in the sham group and in the left-brain–disabled group. More than one-third of the right brain–disabled group accepted any unfair offer, whereas no one in the other groups proved so lenient, the researchers report in a study published online Oct. 5 for an upcoming *Science*.

Only volunteers in the disabled–right brain group spent little time deliberating over unfair offers. They recognized bad deals but found it hard to resist the temptation to make easy money, the researchers propose. —B.B.

D. TUTTLE/SUNY BINGHAMTON

MATERIALS SCIENCE

## A nanotechnology report card

Research on how nanotechnology affects human health and the environment must be expanded, states a National Research Council report.

The National Nanotechnology Initiative, created by the Clinton administration in 2000, coordinates the many federal agencies that fund nanotechnology research. In 2003, Congress mandated that the National Research Council, an arm of the National Academies, conduct triennial reviews of the initiative.

The first review, released Sept. 25, presents a mixed picture. It cites several of the initiative's accomplishments, such as the establishment of five new nanoscale science research centers, operated by the Department of Energy. But the report also notes that the United States' leadership in the field is fading. For example, both Japan and the European Union are catching up to U.S. funding levels.

Overall, U.S. researchers are "facing significant and increasing international competition," the report says. In the early 1990s, U.S. scientists contributed 40 percent of the papers published globally on nanotechnology, but their share dropped to less than 30 percent in 2004.

The report acknowledges studies showing that engineered nanomaterials can harm laboratory animals but concludes, "it is not possible yet to make a rigorous assessment of the level of risk posed by this class of materials." The report calls for more research on how nanomaterials affect people and ecosystems. Meanwhile, it recommends taking "precautionary measures" to guard the health of workers, the public, and the environment.

"Addressing the ethical and social impact of nanotechnology will require an integrated approach among scientists, engineers, social scientists, toxicologists, policy makers, and the public," the report concludes. —A.C.

BIOMEDICINE

## Novel approach fights leprosy

An antibiotic typically used to fight sinus infections and pneumonia shows remarkable potency against leprosy.

In a study of leprosy patients in the Philippines, Robert H. Gelber, a physician at the University of California, San Francisco and his team treated 10 men with oral moxifloxacin daily for 2 months, followed by standard drugs for leprosy. Within 2 weeks of the moxifloxacin therapy, skin lesions on the men were clearing up. Skin biopsies showed that in all 10 patients, *Mycobacterium leprae*—the microbe that causes the disease—was undetectable within a week or two.

"In my 40 years of treating leprosy, I've never seen anything like this," Gelber says.

Typically, doctors use drug combinations against the disease, which as of 2004 afflicted 286,000 people worldwide. Gelber says that moxifloxacin by itself killed the microbe faster than the commonly prescribed rifampin or any other antimicrobial he has used against leprosy.

Because of the facial disfigurement that leprosy causes, a treatment that works faster than the standard drug combinations do would be welcome, Gelber says. "Leprosy patients get very discouraged" with the slow pace of improvement on standard treatments, he says. "They lose confidence that the stuff is really working."

Although Gelber noted that this trial was just a pilot study, he predicts that moxifloxacin will become a regular part of drug combinations for the disease. —N.S.

VIROLOGY

## Hotel-room surfaces can harbor viruses

Rhinovirus, which is responsible for roughly half of all common colds, survives on surfaces in hotel rooms for hours and can be transferred from there to people, a study shows.

J. Owen Hendley, a pediatrician at the University of Virginia School of Medicine in Charlottesville, and his colleagues obtained mucus samples from 15 people who had active rhinovirus infections. The scientists then invited each participant to spend a night in a hotel room. Each person was instructed to remain awake in the room for at least 5 hours in the evening and to spend at least 2 hours there the next day.

Afterward, the researchers tested several surfaces in the rooms, such as television remote controls, doorknobs, telephones, and light switches. In all, 52 of 150 tested surfaces had detectable rhinovirus traceable to the study participant who had stayed there.

To re-create the rest of the suspected infection pathway, the researchers brought five of the volunteers back to the hotel several weeks later. Before each volunteer arrived, the researchers placed drops of that person's stored, rhinovirus-laden mucus on light switches, telephone handsets, and the phones' keypads in two hotel rooms. In one room, the mucus samples were placed the night before; in the other room, a half hour before each volunteer's arrival.

The researchers asked each volunteer, with clean hands, to touch each of the "infected" objects. After each touch, a scientist tested the participant's finger for the virus. The tests showed that the virus was again present on the fingers of these people—who were now immune to reinfection—in 10 of 30 instances in which they touched surfaces infected the night before and in 18 of 30 of the instances of freshly infected surfaces.

The findings underscore the need for hand washing, particularly around the home, where most disease is spread, Hendley says. People presumably infect themselves by touching a contaminated surface and then putting a finger to an eye or nose, he says.

The findings raise questions about commercial areas besides hotel rooms, he says. The virus remains more accessible on smooth surfaces than it does on cloth or other textured surfaces, so "I wonder about menus" in restaurants, Hendley says. —N.S.

BIOMEDICINE

## Statins defend against fungus-caused sepsis

When a blood infection causes an inflammatory reaction that attacks the entire circulatory system, the result is a condition called sepsis that's fatal about 40 percent of the time. A new study suggests that sepsis brought on by a fungal infection is less lethal in people taking cholesterol-lowering pills called statins than in those not getting the drugs.

Physician Graeme Forrest of the University of Maryland Medical Center in Baltimore says that he noticed reports suggesting that statins improve the survival chances of people who had sepsis triggered by bacterial infections.

To see whether there was a similar effect for fungus-triggered sepsis, Forrest and his Maryland colleague Angela Kopack examined the records of 35 patients with fungal-induced sepsis treated at the medical center between 2003 and 2005. Of these people, 12 were taking statins upon admission to the hospital and 23 were not. Patients in both groups had similar rates of heart and kidney disease and tended to be elderly.

After 30 days of treatment, people who had been taking statins were three times as likely to have survived their attacks of sepsis as were those not getting the drugs. That benefit held up 100 days after sepsis was diagnosed, the researchers report. The preliminary finding suggests the need for further study of whether statins were indeed responsible for the survival advantage, Forrest says. —N.S.

INFECTIOUS DISEASES

## Many infections tied to medical settings

More than one-fourth of skin or muscle infections that require hospitalization originate from microbes acquired in a clinic, hospital, or other medical-care setting, researchers find.

Using data from 134 hospitals in the northeastern United States, scientists identified 7,329 cases of infection caused by no more than one microbe. The infections typically followed trauma, surgery, or an invasive medical procedure such as kidney dialysis. The researchers excluded infections of the lungs and urinary tract. *Staphylococcus aureus* accounted for 55 percent of all infections.

The scientists found that 27 percent of the infections arose from microbial strains acquired in hospitals. People with such infections were three times as likely to die in the hospital as were patients whose infections originated outside the medical setting, says physician Benjamin A. Lipsky of the University of Washington School of Medicine in Seattle.

People with infections acquired in medical settings "have a different prognosis" because the microbe involved is more likely to be resistant to some drugs, so doctors should treat those infections with targeted drugs rather than broad-spectrum antibiotics, Lipsky says. —N.S.

# Books

A selection of new and notable books of scientific interest

### INFRASTRUCTURE: A Field Guide to the Industrial Landscape

**BRIAN HAYES**

The typical modern landscape is telephone poles, water towers, and train tracks. This unusual book uses the model of the field guide to identify and describe these familiar, yet often ignored, elements of the industrial landscape. Hayes encourages a closer look at the infrastructure that is so vital to modern life. Whether his topic be mines for valuable commodities such as coal and granite, waterworks and dams, or oil and gas pipelines, Hayes describes how this infrastructure is constructed, maintained, and operated. He also addresses the placement of infrastructure, noting which structures are in harmony with their natural surroundings. Hayes describes the inherent beauty of the humanmade world. ***W.W. Norton, 2005, 536 p., color photos, paperback, $35.00.***


### KING OF INFINITE SPACE: Donald Coxeter, the Man Who Saved Geometry

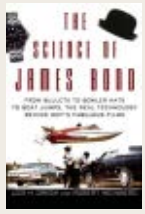
**SIOBHAN ROBERTS**

This book is an homage to Donald Coxeter, whose efforts, Roberts asserts, saved classical geometry from virtual elimination from modern mathematics. Roberts, a journalist, details how this mathematical prodigy's work on the principles of symmetry and group theory defended "visual mathematics" during the 1940s, when a group known as the Bourbakis asserted geometry's irrelevance. Coxeter's work, especially his treatise entitled *Regular Polytopes*, went on to influence various people, including Buckminster Fuller, who credits Coxeter's vision in developing his famous geodesic domes. Famed graphic artist M.C. Escher was also known to invoke Coxeter's inspiration. Roberts ends this detailed biography with appendixes on Coxeter groups and diagrams as well as Fibonacci numbers and phyllotaxis. Also included is the text of a lecture by physicist Freeman Dyson on "unfashionable pursuits" such as Coxeter's. ***Walker & Co., 2006, 399 p., hardcover, b&w images, $27.95.***


### THE SCIENCE OF JAMES BOND: From Bullets to Bowler Hats to Boat Jumps, the Real Technology behind 007's Fabulous Films

**LOIS H. GRESH AND ROBERT WEINBERG**

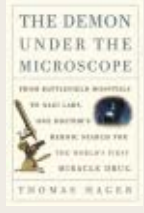
The most famous fictional spy accomplished many seemingly impossible feats armed with a wide array of fantastic gadgets and weaponry. Authors Gresh and Weinberg comb the Bond films, pondering the scientific credibility of each death-defying leap, super equipped vehicle, and ingenious weapon. The authors provide a review of the physics that would apply to a flying car. They ponder the effects of a nuclear bomb such as the one devised by the villainous SPECTRE organization. They review the plausibility of the various items devised by British intelligence's Q Division to keep Bond alive, including the jet pack that saw development by the U.S. Army in the 1960s, false fingerprints, and voice-altering technology that is today available in computer software. For true Bond lovers, appendixes detail, among other topics, the science of martinis and of Bond's cars. ***Wiley, 2006, 212 p., paperback, $14.95.***




### THE DEMON UNDER THE MICROSCOPE

**THOMAS HAGER**

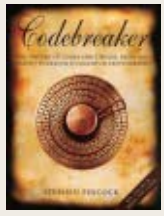
A century ago, physicians sought a way to overcome their helplessness against often-deadly infections. They found it during World War II in the form of sulfa drugs, precursors to modern antibiotics. Hager, a science and medical writer, tells the compelling story of the discovery of this lifesaving treatment. The saga begins with Gerhard Domagk, who as a field physician for the German army in World War I witnessed soldiers' deaths and then dedicated his life to finding a way to protect other soldiers against the ravages of bacteria. His studies led to his eventual employment in the mid–1930s at the then-new pharmaceutical company Bayer, a subsidiary of the German company I.G. Farben. While there, he experimented with dyes as antibiotics and discovered that a dye component, sulfanilamide, killed strep and tuberculosis bacteria. Hager describes how chemists subsequently refined sulfa drugs to fight other types of infection and how this class of drugs changed medicine. ***Harmony, 2006, 340 p., hardcover, $24.95.***




### CODEBREAKER: The History of Codes and Ciphers, from the Ancient Pharaohs to Quantum Cryptography

**STEPHEN PINCOCK**

Since the early days of written symbols, scribes have used encryption for amusement as well as for concealment. Pincock details the history of ciphers, codes, and code breaking. Shortly after the year 750, Muslim scholars realized that in any language, letters appear with regular frequency and that analysis based on that fact could crack ciphers. Pincock details historic events that were affected by the use of codes, including Mary Queen of Scots' encrypted messages to Queen Elizabeth's would-be assassins and the cracking of the famous Enigma ciphers during World War II. Pincock also details still-unbroken codes, including that of the mysterious Voynich Manuscript and that used by a serial killer in California during the 1960s and '70s. The modern world, he notes, has an increasing reliance on cryptology for protecting information sent digitally. ***Walker, 2006, 176 p., color photos, hardcover, $19.95.***

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# LETTERS

### Name game

"Named medical trials garner extra attention" (*SN: 8/5/06, p. 93*), I think, has it backwards. It's not that labeled trials are more likely to be funded. Rather, well-funded, large trials are more likely to be named. We research chemists label only the important projects. The name makes the project easier to track and reference.

**CHARLES D. SHUSTER,** COLUMBUS, OHIO

### Behind the IQ numbers

I suspect the findings in "Racial IQ Gap Narrows: Blacks gain 4 to 7 points on whites" (*SN: 8/5/06, p. 85*) might be correlated with the reduction in lead exposure over the same timeframe. I wonder if the greater reduction in early-childhood blood lead for blacks might be sufficient to explain the effect described in the study.

**RICHARD B. MOTT,** RINGOES, N.J.

What can we conclude from these facts? Not much, because, as the psychometrician states, we do not actually know what intelligence is, nor do we know what intelligence tests actually measure other than performance on the tests themselves.

**DAVID P. VERNON,** TUCSON, ARIZ.

### Whom do you trust?

"Outside Looking In" (*SN: 8/12/06, p. 106*) states, "Yet individuals with Asperger syndrome can still look at a face and assess characteristics such as trustworthiness." Statements like that are mystifying to me. I think I am about average in social intelligence, but I can't imagine even thinking of looking at a stranger's face and deciding whether or not the person is trustworthy.

**MOLLY WEEKS,** PEMBROKE PINES, FLA.

*People assess the trustworthiness of others all the time—in business deals, purchases, and asking for directions, for instance.* —B. BOWER

### Fuzzy maybe, warm no

Regarding "Obsidian artifacts can record ancient climate" (*SN: 8/12/06, p. 110*), did the researchers take into account that most arrow points and spearheads would have been in contact with the inside of game, a considerably warmer and more humid environment than the ground where the points were found?

**DANIEL WOITULEWICZ,** DETROIT, MICH.

*The material would be inside game—and at a higher temperature than the environment—for only a short while.* —S. PERKINS

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