

# SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

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dino dug burrows  
odors disrupt shoaling fish  
vibrating the fat away  
bigger black holes

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## under the weather

AUSTRALIA'S DAMAGING DROUGHT





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### Digging the Scene

Dinos burrowed,  
built dens

**Paleontologists have unearthed an ancient, sediment-filled burrow that holds remains of the creatures that dug it. The find is the first indisputable evidence that some dinosaurs maintained an underground lifestyle for at least part of their lives.**

While scouring 95-million-year-old strata in southwestern Montana, paleontologist David J. Varricchio of Montana State University in Bozeman and his colleagues stumbled upon an unusual patch of sandstone protruding from the rock that surrounded it. Soon after they began to

excavate the sandstone, they found a compact mass of small bones. After teasing apart the tangle, they discovered that the remains represented an adult and two juvenile dinosaurs of a completely new species.

Further excavation revealed that the sandstone mass was S-shaped and about 2.1 meters long. For most of its length, the sinuous feature had an oval cross section about 30 centimeters wide and about 40 cm tall. However, at its lower end—where the dinosaur bones were found—it broadened to a width of 45 cm. The elongated sandstone mass cut through three distinct layers of stone derived from mud and clay, a sign that those strata were in place before the material that formed the sandstone arrived, says Varricchio.

Individual bones in the fossils were unbroken and showed no signs of having been weathered before they were buried. Varricchio and his colleagues propose that the anomalous mass of sandstone represents a sudden influx of material that filled in a burrow, trapping its occupants.

The dinosaur skeletons found in the burrow were essentially complete. That, plus a lack of bite marks on the bones, suggests that the creatures hadn't been dragged into the burrow by a predator, says Varricchio.

This newly discovered combination of burrow and bodily remains is the first strong evidence of a digging, denning dinosaur, the researchers propose. The two juvenile dinosaurs were two-thirds the size of the adult, a finding that bolsters the

a paleontologist at the University of Chicago.

The newly described dinosaur's 1.25-m-long tail accounted for most of the slim creature's estimated 2.1-m length. In adulthood, it would have stood knee-high to humans, says Varricchio. Broad flanges on the upper bones of the creature's forelimbs indicate where large muscles attached, he adds. Similar features, which provide increased leverage while digging, are found on the analogous bones in modern-day armadillos.

The dinosaur's broad hips suggest that it could have braced itself in a wide stance while burrowing. The foremost bones in its skull were fused, a characteristic that could have enabled the creature to dig more effectively.

Scientists have noted similar skeletal features on several close relatives of *Oryctodromeus*, says Thomas R. Holtz Jr., a paleontologist at the University of Maryland at College Park. Burrowing dinosaurs may have been more common than paleontologists previously suspected, he suggests. —S. PERKINS

### Catch a Wave

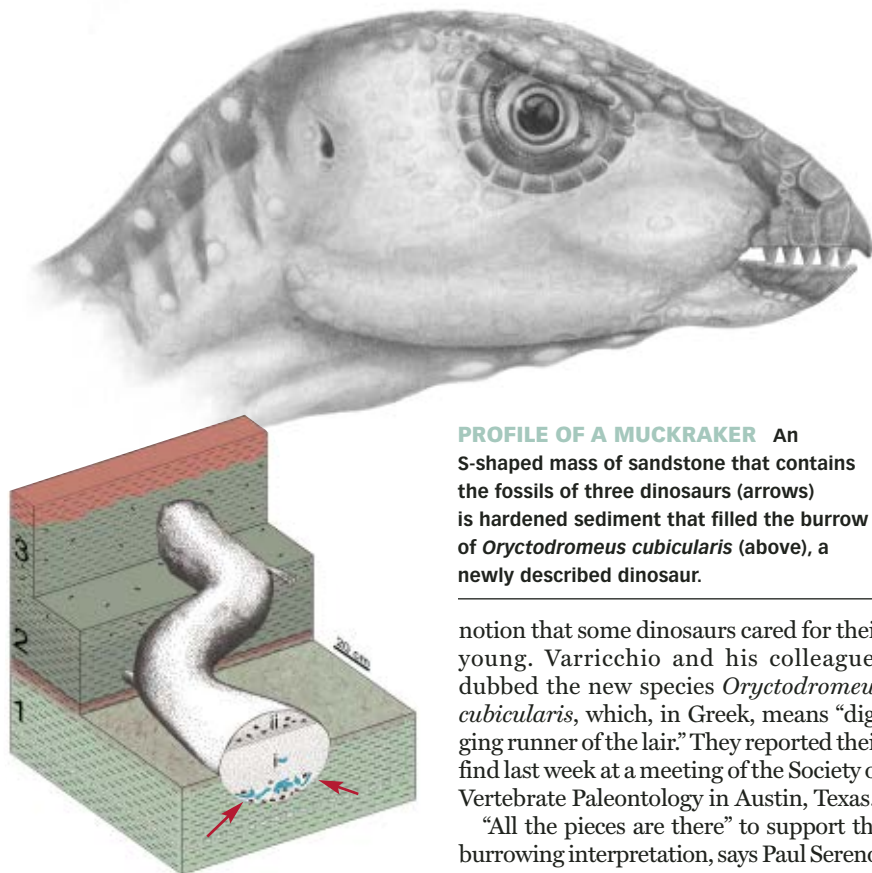
Carbon nanotubes  
go wireless

**Despite all the hubbub about carbon nanotubes as possible building blocks of super-strong materials or as components of super-small electronics, few practical applications have yet come to fruition. Integrating nanotubes into functioning electronic devices has proved especially difficult, but researchers have now built a carbon-nanotube component into a simple radio receiver.**

"We're showing a system that works that has a nanotube as one of the key components," says Peter Burke of the University of California, Irvine.

Burke and graduate student Chris Rutherglen placed a nanotube—1 nanometer in diameter and 50 micrometers long—on the surface of a silicon chip. They then attached metal contacts to each end of the nanotube so that they could connect it to an electronic circuit that could receive signals from a standard radio antenna.

To test the system, the researchers broadcast music at a frequency of 1 gigahertz (GHz). They used amplitude modulation (AM), in which the rapidly varying intensity of the radio waves carries the desired broadcast signal. The nanotube device demodulated the received radio transmission, producing an output voltage that could be fed into an amplifier. The receiver picked up the radio waves up to a meter away from the transmitter, the researchers report online and in an upcoming issue of *Nano Letters*.



**PROFILE OF A MUCKRAKER** An S-shaped mass of sandstone that contains the fossils of three dinosaurs (arrows) is hardened sediment that filled the burrow of *Oryctodromeus cubicularis* (above), a newly described dinosaur.

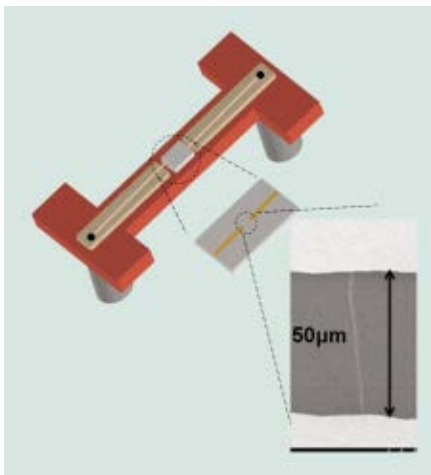
notion that some dinosaurs cared for their young. Varricchio and his colleagues dubbed the new species *Oryctodromeus cubicularis*, which, in Greek, means "digging runner of the lair." They reported their find last week at a meeting of the Society of Vertebrate Paleontology in Austin, Texas.

"All the pieces are there" to support the burrowing interpretation, says Paul Sereno,

The system is rudimentary, with a limited range and no advantage in sound quality. "This was proof of concept to show that it can be done," Burke says.

He and Rutherglen see their work as a milestone in moving nanotubes from scientific curiosity to technological workhorse. With further refinement, their device could lead to components for a variety of nanoscale wireless systems, including radio, television, or cell phone technology, they say. The next step will be to build more-complicated components, such as a nanotube amplifier, Burke adds.

"This work really demonstrates in a compelling way the ability of carbon nanotubes



**TINY RADIO** A single carbon nanotube (lower right), hooked up to wires to become the heart of a small electronic device (upper left), can produce an output voltage from an AM-radio transmission.

to operate at high frequencies in electronic systems and do useful things in realistic devices," says John Rogers of the University of Illinois at Urbana-Champaign. He cautions, however, that making integrated circuits will be more challenging than building the single component was.

Burke's group is trying to make nanoscale manufacturing less costly, but he says that that expense remains the greatest obstacle to wide commercialization of nanotube devices.

A nanotube radio could serve as a catalyst to help boost the material beyond the laboratory and lead to a range of technological applications, just as the transistor radio sparked the development of other transistor-based devices, Rogers says. "It's a long, hard path going from science-based work that has dominated

nanotube research [and] moving it towards a real technology. This is an important step," he adds. —S. WEBB

## Let There Be Aluminum-42

### Experiment creates surprise isotope

**Physicists have created the heaviest isotope** yet of magnesium, but in their experiments an unexpected isotope of aluminum also showed up. The findings could help astrophysicists understand occasional X-ray emissions from neutron stars that are growing in mass.

The 7-day-long experiment took place at the National Superconducting Cyclotron Laboratory (NSCL), an atom smasher at Michigan State University in East Lansing. Hoping to test the limits of how many extra neutrons will bind to an atomic nucleus, researchers were trying to create magnesium-40, a heavyweight element with 18 more neutrons than the most common isotope, magnesium-22. Standard theory says that magnesium-40 should be the heaviest isotope of the element that can exist, if only for a fleeting instant, before decaying.

NSCL's Thomas Baumann and his colleagues shot nuclei of calcium-48—the heaviest naturally occurring calcium isotope—at a tungsten foil at about half the speed of light. Atomic collisions created all sorts of debris, including fragments from both calcium and tungsten nuclei, out of which new atomic nuclei occasionally formed.

Like Adam in the book of Genesis, the heavy magnesium nuclei started appearing on the fifth day of the experiment. The researchers picked up three of them among the quadrillion particles produced. And it was very good, but then something even more interesting happened (think Eve). The detector recorded 23 particles whose charge and mass marked them as aluminum-42, the researchers report in the Oct. 25 *Nature*.

According to Baumann, most theories had predicted that aluminum-42 wouldn't exist. While physicists know that the strong nuclear force keeps atomic nuclei together, they cannot calculate exactly the complex interplay of forces among neutrons and protons. Several competing models aim to approximate this interplay. "The range of predictions is pretty broad," says Baumann.

The discovery of aluminum-42 suggests that even heavier aluminum isotopes could exist, says Paul-Henri Heenen of the Free University of Brussels in Belgium. And other elements, higher in the periodic table, might also be able to accommodate more neutrons than expected.

"It's interesting, but also worrisome," says

Hendrik Schatz, an NSCL physicist who was not involved in the experiment. In particular, he says that the results complicate physicists' efforts to understand how stars and supernova explosions forge neutron-rich isotopes as intermediate steps toward creating elements heavier than iron.

Schatz says that the new results are even more directly relevant to another astrophysical scenario. When matter falls onto a neutron star and starts sinking into its crust, pressures 10 trillion times as high as those at the sun's center force electrons and protons to merge, forming neutrons. The transient formation of isotopes such as aluminum-42 and magnesium-40 during this process could help explain certain anomalous flashes of X rays that astronomers have observed coming from neutron stars, Schatz speculates.

The experiment was a "tour de force," says Michael Pearson of the University of Montreal, adding that the results should help discriminate between different nuclear models. However, he says that existing theories might still apply to elements that are heavier than aluminum. —D. CASTELVECCHI

## Good Buzz

### Tiny vibrations may limit fat-cell formation

**Young mice that spend time on a mildly** vibrating platform increase muscle and bone production at the expense of fat, researchers report. The finding suggests that exposure to subtle mechanical movement—even a modest buzz—might beneficially influence cell formation, says study coauthor Clinton T. Rubin, a bioengineer at Stony Brook (N.Y.) University.

Rubin's team tested laboratory mice by allowing some to spend 15 minutes a day on buzzing platforms while others remained on solid surfaces. After 9 to 15 weeks, the mice exposed to the vibrations had less fat than the other mice did. Other measurements showed that shaken mice made fewer new fat cells and also had lower concentrations of triglycerides and nonesterified free fatty acids in their livers. Both compounds are linked to type 2, or adult-onset, diabetes. The study will appear in the Nov. 6 *Proceedings of the National Academy of Sciences*.

Rubin refrains from extrapolating these findings to people. He also distances himself from companies that sell vibrating platforms as weight reducers. The intense vibration of such machines "is very, very nasty stuff," he says, and is associated with circulatory disease, hearing loss, back pain, and other ailments.

By comparison, the vibration of the platform used in the mouse experiments is quite restrained. "If you put your hand on it, you can barely feel it," he says.



Nevertheless, the animals seem to detect these mechanical signals at the cellular level. The researchers tracked the fate of the animals' newly minted mesenchymal stem cells—blank slate precursor cells made in the bone marrow that can become fat cells, bone cells, or muscle cells. In this study, vibration tilted differentiation in favor of muscle and bone.

"The data suggest a positive effect," says geneticist Claude Bouchard of the Pennington Biomedical Research Center in Baton Rouge, La. "It's a very intriguing paper, and it's going to generate a lot of attention."

Bouchard notes, however, that while shaken mice had lower concentrations of triglycerides and fatty acids, no differences emerged in insulin or blood-glucose measurements. He also says that further tests will need to clarify whether a part of the apparent benefits of the vibration is simply that it causes the mice to burn off some fat. "You would expect that [vibration] would require some muscle contraction," he says. "The reaction is to try to stick to the ground."

Although the vibrations fall well short of the jarring motion of exercise, the study may shed new light on the benefits of exercise and the perils of a sedentary lifestyle. Could it be that inactivity causes children to make more fat cells, predisposing them to obesity and diabetes later in life?

"Fat cells are hard to get rid of," Rubin says. "Interfering with the number of fat cells made could have an impact," he hypothesizes, "but we're not suggesting that buzzing reduces diabetes directly."

He and his team are currently exposing mice to the buzzing for a full year to watch for long-term effects.

In the meantime, he counsels people against "sitting on their washing machines, hoping to get skinny." —N. SEPPA

## Odd Couples

### Big black holes challenge star theory

The most massive stars in the universe collapse to form black holes at the end of their lives. Theory suggests that such black holes can't have much more than about 10 times the sun's mass, but a team has now identified one that tips the scales at 15.65 times the sun's mass. Another research group has tentative evidence of an even bigger beast.

The findings may call into question current predictions about the evolution and ultimate fate of heavyweight stars.

Jerome Orosz of San Diego State University and his colleagues studied a pair of closely orbiting stars in the nearby galaxy M33. As seen from Earth, each star periodically passes in front of the other, and the durations of



**BIG HOLE** A star (blue object) about 70 times as massive as the sun orbits a black hole 15.65 times the sun's mass in the nearby galaxy M33 in this artist's depiction. A gas and dust disk (orange) encircles the black hole. Bright blue object (inset) in this composite X-ray and visible-light image is the orbiting stellar pair, known as M33 X-7.

these eclipses revealed that one of the partners must be extremely compact. From visible-light observations, the researchers determined that the other star has a mass 70 times that of the sun. Knowing that star's mass and orbit, they calculated that the compact partner weighs 15.65 solar masses. That would mean it must be a black hole—in fact, the heaviest stellar-mass black hole ever to be precisely measured, Orosz and his colleagues report in the Oct. 18 *Nature*.

The pairing of such a black hole with a massive normal star "is very difficult to explain using stellar evolutionary models," the team asserts. The more massive a star, the shorter its life span. So if the two stars in M33 were born around the same time, the one that reached the end of its life first and collapsed to become the black hole must have started out with a greater mass than the surviving normal star. The collapsed star's initial mass would probably have been about 100 times that of the sun, suggests Orosz.

This may pose a puzzle, however, because such a massive star would generate a fierce wind that would carry off a significant fraction of its mass. Earlier in its evolution, moreover, the heavy star would have briefly ballooned in size and spilled material onto its lower-mass partner. This mass loss could

make it difficult for the star to remain heavy enough to form the giant black hole.

Theorist Vicky Kalogera of Northwestern University in Evanston, Ill. says that the finding might not be a problem. However, the possible detection of an even bigger black hole, reported in the Nov. 1 *Astrophysical Journal Letters*, poses a challenge, she says.

A team led by Andrea Prestwich of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., examined X-ray emissions from a spot in the nearby galaxy IC 10 and found that the radiation waxes and wanes every 34.4 hours. The most likely source of the X rays is a bright, heavy star eclipsed by a more compact body, the researchers say. To explain the observations, the heavy star's partner would have to be a black hole 25 to 34 times as massive as the sun.

The likely existence of huge stellar black holes, along with observations of massive stars, suggests that stellar winds drive off only one-third to one-tenth as much mass as researchers had previously supposed, says Nathan Smith of the University of California, Berkeley. An analysis he recently posted online at <http://xxx.lanl.gov/abs/0710.3430> suggests that tamer winds would mean that the predicted fate of massive stars "may need to be revised." Unex-

pectedly heavy stellar-mass black holes may be abundant in the modern-day universe, Smith suggests. —R. COWEN

## Not So Clear-Cut

### Soil erosion may not have led to Mayan downfall

**Hand-planted maize, beans, and squash** sustained the Mayans for millennia, until their culture collapsed about 1,100 years ago. Some researchers have suggested that the Mayans' very success in turning forests into farmland led to soil erosion that made farming increasingly difficult and eventually caused their downfall. But a new study of ancient lake sediments has revealed that most erosion happened well before the culture collapsed and likely played only a small role in disrupting the civilization.

"When you clear a forest, you open up the soil and expose it to rainfall and weathering," says Flavio S. Anselmetti, now of the Swiss Federal Institute of Aquatic Science and Technology in Duebendorf. In the tropical lowlands, he explains, clay soils can drift substantially, but only after forest clearing.

To assess soil erosion during the Mayan era, Anselmetti's team measured how much clay had washed into Guatemala's Lake Salpetén. The layer of clay, 7 meters thick at some spots, contrasts sharply with nutrient-rich organic material below and above it, which was deposited before and after the Mayan period.

By analyzing the ages of different layers within the clay, the researchers determined that most of it accumulated 2,700 to 4,000 years ago, early in the Mayan era. Erosion must have begun as soon as the Mayans started clearing land for agriculture, say Anselmetti and his colleagues in the October *Geology*.

Vernon L. Scarborough of the University of Cincinnati says that the new results make him rethink the role erosion played in the collapse of the Mayans. He notes that the Mayans' complicated irrigation and terracing schemes would have taken a vast amount of maintenance, and that this upkeep might have faltered with any initial crumbling of the society. The resulting erosion and damage to agriculture could have further weakened the societal framework.

"One of our thoughts was that [the Mayans] terraced and manipulated the landscape so dramatically that when they left it basically all slid away," says Scarborough. But that would have deposited a second wave of clay in the lake basin about 1,100 years ago, and no such layer is evident.

The state of the soil could still have played a role. Erosion over thousands of years could have thinned the soil so much that growing anything at all may have been difficult during the decline of the civilization, says Anselmetti.

"This is just a puzzle piece in a multi-causal cascade that made their lives miserable," he adds.

He stresses that the ancient course of erosion might hold important modern-day lessons. Since the 1950s, Guatemala's population has exploded, and people are once again clear-cutting land that had just barely recovered from the agriculture of the Mayans. Understanding what happened 2,000 years ago could help minimize new damage to the land, says Anselmetti. —S. WILLIAMS

## Smells Funny

### Fish schools break up over body odor

**Just an hour's swim in water lightly contaminated** with a common pollutant can turn fish into rejects with an odor that causes their untainted schoolmates to shun them, researchers say.

In a lab test, brief exposure to 4-nonylphenol (4-NP), a surfactant used in many soaps, detergents, and other products, disrupted the normal tendency of banded killifish (*Fundulus diaphanus*) to cluster in shoals, says Ashley J. W. Ward, now of the University of Sydney in Australia. Contaminant concentrations were similar to what the fish might encounter near a sewage treatment outlet, he and his colleagues report online in *Proceedings of the Royal Society B*.

The finding ranks as "the first demonstration that low levels of a common environmental contaminant can affect shoaling," comments Bob Wong of Monash University in Melbourne, Australia.

The first generation of experiments on fish exposure to pollutants focused on physiological effects, but research is now turning to subtle effects on behavior, says Wong.

Breakdown of shoaling behavior bodes ill for fish. They improve their odds of surviving attack when they gather in swirling masses. A predator loses its edge when it lunges into the confusion and has to pick a target, an effect described as "the dog-with-two-bones problem," says Ward. Shoaling brings other benefits, such as efficiency in locating food and picking up signs of dan-



**GOOD SCHOOLS** Pollution may disrupt the shoaling of some fish, a behavior that brings them safety and better foraging.

ger. Anything that sabotages this behavior suggests "huge consequences to fitness," says study coauthor Suzanne Currie of Mount Allison University in Sackville, New Brunswick.

Her lab had been studying the effects of 4-NP on fish. This chemical shows up in pesticides, detergents, and processing chemicals for sewage plants. "It's virtually ubiquitous," says Ward.

Currie and her colleagues had previously found that low concentrations of 4-NP upset the social hierarchy among trout, inflaming aggression. To look in more detail at social responses to the pollutant, Ward, Currie, and their colleagues switched to the small, brownish killifish, notable for its strong shoaling instinct.

The researchers gave one cluster of fish a short swim in 4-NP at concentrations of 1 microgram per liter and 2 µg/l. Even the higher concentration is too low to cause signs of stress, says Ward. Concentrations near sewage treatment outfalls range from 0.5 µg/l to 343 µg/l, according to the 2002 Helsinki Commission Report.

Researchers then put the fish in an aquarium of uncontaminated water and let the flow from it carry the fishes' body odor as it washed down over a test subject in another tank. Normally, the downstream killifish would swerve into the odor trail of potential pals ahead. In this case, the test fish moved to avoid the plume.

When the researchers switched the procedure, bathing the test fish but not the upstream cluster in 4-NP, the effect disappeared. The pollutant isn't disrupting the ability to pick up odor cues, says Ward. It's changing the signal itself.

Other pollutants, such as cadmium, are known to jam a fish's odor receptors, so soups of pollutants worry Ward. "There could be a horrible, synergistic effect," he says. —S. MILIUS



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# VIRTUAL WORLDS, REAL SCIENCE

## Epidemiologists, social scientists flock to online world

BY BRIAN VASTAG

**S**keletons paved the cobblestone streets. Thousands had succumbed to the blood plague quickly, but others lingered—only to infect everyone they met. No one was safe. Warriors, mages, and healers all fell. Word spread, urging everyone to flee, but still the plague ripped through the world, creating a holocaust.

A hulking, serpentine blood god, Hakkar the Soulflayer, had sparked the epidemic. Attacked in his dungeon, the monster unleashed his final defense—a curse called corrupted blood. The curse infected the attackers and quickly spread to their companions like an ultra-virulent airborne virus. As adventurers fled the dungeon, they carried the illness back to their towns. Soon the plague even crossed into animals. Within days, the World of Warcraft—a hugely popular online adventure game—was devastated.

Although the death of a character in the World of Warcraft is a mere annoyance—the character disappears for a minute or two and then rematerializes—the plague proved unstoppable. Eric Lofgren was playing the game during the virtual outbreak in September 2005. “It was a big deal,” says Lofgren, who at the time was an epidemiology student at Tufts University in Boston. “Early on, it wasn’t clear how it spread or what was going on. Players attempted to heal other players ... not knowing that they were taking damage and indeed spreading the plague. There was a lot of confusion. A lot of people abandoned [the game] until it got sorted out.”

It took Blizzard Entertainment, the Irvine, Calif., company behind World of Warcraft, nearly a week to stop the virtual plague. At that time the online Tolkeinesque world of swords and sorcery boasted 4 million subscribers (it now has 9 million). To enrich the game, the company’s programmers had created Hakkar and made the monster so strong that players would have to band together to kill it. The programmers placed Hakkar in a remote dungeon and expected his blood curse to remain localized there. But they hadn’t accounted for human behavior.

Instead of staying in the cave, infected players teleported to the towns. Soon, their virtual pets became infected—and contagious. Both man and beast spread the disease to densely populated areas, where weaker characters who contracted it died instantly. Computer-controlled characters such as shopkeepers also became infected, but didn’t die. Along with the pets, these characters acted as silent carriers, virtual Typhoid Marys.

It turns out that Lofgren’s adviser at Tufts, Nina Fefferman, specializes in computer modeling of infectious diseases. When Lofgren told her about the virtual chaos, she called Blizzard. Enticed by parallels between the virtual and actual outbreaks, Fefferman asked the company to preserve the plague data. “Their initial reaction was confusion,” she says. “They said, ‘This is a bug, we’re worried about fixing it, we’re not worried about logging data for you.’”

Minus Blizzard’s help, Fefferman and Lofgren still learned enough from observing the outbreak, reading accounts on game-related Web sites, and interviewing players to publish a paper in *Lancet Infectious Diseases* this August. In it, they outline the potential of garnering valuable lessons from virtual outbreaks.

With that publication, the pair joined a growing cohort of behavioral scientists who are mining virtual worlds for real data on human behavior.

**REAL LESSONS** Computer programs that model how infectious diseases spread aren’t new. Government and university researchers have been developing them for decades. But, say Fefferman and her colleagues, studying the actions of the millions of real people invested in World of Warcraft and other online worlds could substantially boost the reality quotient of disease simulators.

“The [computer] models we have are incredibly good at figuring out what the disease will do once we know what the behavior of the person is,” Fefferman says. But the models make broad assumptions about how people will behave, and “we’re pretty bad at knowing what those assumptions should be.”

Lofgren, now an epidemiology graduate student at the University of North Carolina, Chapel Hill, says that “it is extremely hard mathematically to model risk aversion, or panic, or altruistic behavior, or noncompliance with quarantines.” World of Warcraft players exhibited all of these behaviors during the outbreak.

In March, Ran Balicer, an epidemiologist at the Ben-Gurion University of the Negev in Be’er-Sheva, Israel, published a paper in *Epidemiology* outlining two particularly striking parallels between Hakkar’s curse and real epidemics. First, virtual teleporting is like air travel, spreading bugs across the world in a flash. Severe acute respiratory syndrome (SARS), for instance, originated in China, but quickly dispersed as infected patients traveled in airplanes. Second, animals often act as reservoirs of human disease. With avian influenza, some fowl, especially ducks, “catch the disease in a mild way and then they transmit it onward, much like the animals in the game did,” Balicer says.

More interesting to Fefferman is the “complete diversity” of player behavior reported. Some players logged out—a panic response with obvious parallels in the real world. Others deliberately spread the corrupted blood. These “griefers,” so called because they rejoice in virtual destruction, propagated what Balicer calls “the first act of virtual bioterrorism.” Still others put themselves at risk to heal the infected, not unlike first responders to, say, the current Ebola outbreak in West Africa.

One of the more interesting group dynamics, says Fefferman,

### STATS

9  
million

Monthly  
subscribers  
to the online  
game World  
of Warcraft



was the influx of characters to disease epicenters. Many came not to heal or sow chaos, but just to be near the action. In a game where the cost of virtual death is small, such thrill-seeking makes sense. But Fefferman and others say it's conceivable that similar behavior would emerge during a real epidemic.

"I tend to think it's more realistic than we acknowledge, that there would be motivations for people to go to the disaster," says William Sims Bainbridge, director of the Human-Centered Computing Cluster at the National Science Foundation (NSF) in Arlington, Va. During a smallpox outbreak, for instance, he says "if you believe, like I do, that the federal government can't succeed in containing it, you would rush to the place where they were giving immunizations, knowing that the smallpox was going to get everywhere pretty soon. It goes well beyond curiosity seeking."

**DROOLING FOR DATA** Social scientists are invading online worlds in droves to study human behavior. For instance, Dimitri Williams, an assistant professor at the Annenberg School for Communication at the University of Southern California in Los Angeles, is working to figure out how he can divine social dynamics from four terabytes of server logs that preserve the actions of the 400,000 players of the online fantasy game EverQuest 2. He plans to look at how groups form in the game and to highlight how the important players—the social hubs—behave. He also plans to study in-game economics. Williams landed a \$200,000 NSF grant for the project.

In September, NSF awarded \$360,000 to a team headed by Robert Kraut at Carnegie-Mellon University in Pittsburgh to study interactions in World of Warcraft and other cyber locales such as the user-written Wikipedia.

At the Palo Alto Research Center in California, Nicolas Ducheneaut and colleagues also study the dynamics of player groups, called guilds, in World of Warcraft. With "robots" programmed to survey the online population of World of Warcraft, Ducheneaut and his team collected data on half a million characters over 3 years. They then identified characteristics of the most successful guilds, which are groups of up to 40 players that adventure together. "People tend to be dismissive of games ... but I could see right away that the kind of organization and interpersonal dynamics you see in guilds are very, very close to what you see in work groups in corporations," he says.

Many in the field credit Edward Castronova of Indiana University with legitimizing such pursuits via his examinations of the economics of virtual worlds. Dan Hunter, an associate professor at the Wharton Business School of the University of Pennsylvania, Philadelphia, calls the burgeoning field "computational social science." This new field is driven by computers, but more importantly by the millions of users who use them to log in to online worlds.

Says Kraut: "It used to be that to study [group dynamics], you had to do very detailed ethnographic-style interviews and observations. But ... researchers recognize the enormous value of automatically collected, long-term, large-scale data. It lets us see [social] structure that's otherwise invisible."

**PLANNING AHEAD** After gleaning early lessons from the accidental World of Warcraft outbreak, Fefferman now wants to insert a planned epidemic into a game world. "It may not have

to look like a realistic disease, it may just have to [be] a perceived risk to something that's emotionally valued," she says.

In the World of Warcraft, death may be fleeting, but if a socially spread threat instead disabled some of a character's abilities, depleted his or her coffers, or destroyed a powerful weapon, risk perception might be more in line with that of a real outbreak, says Williams. "You need a realistic incentive structure. Maybe if you lose treasure or an item that you worked hard for, that might be getting closer to a real-world model—there's a risk the player wants to avoid."

Fefferman's pitch: A planned outbreak could enrich game worlds, offering players a chance to band together to quest for a cure or to build a hospital. "It has to feel less like an experiment and more like another challenge the character lives through," she says.

Support for planned virtual outbreaks is building in academic quarters. Most recently, two computer scientists from Sweden explored how to design a virtual epidemic. In a paper presented at the Digital Games Research Association conference in Tokyo this September, Magnus Boman of the Swedish Institute of

Computer Science and Stefan Johansson of Blekinge Institute of Technology write that carefully designed outbreaks could enhance online worlds, but only if the epidemics "are neither too devastating nor too easy to fend off."

Or, as Williams puts it, "it's not that good epidemiology can't be done, but you really have to know the rules of the game world."

To date, though, game companies have taken a pass on partnering with Fefferman, and, with the exception of Williams, researchers have had no luck convincing game producers to hand over their hard drives. Researchers "can't just say, 'Please help me.' What are [the game companies] getting out of data sharing?" Williams says. His project, for instance, will help Sony pinpoint why players stay in the game.

In the face of reticence from the industry, some academics are

instead designing their own worlds, with limited success. Online games cost millions of dollars, require the talents of dozens of programmers and artists, and devour huge advertising budgets to attract their minions. In October, Castronova shelved a nascent online world of Shakespeare geared for social science research after burning through a \$240,000 grant from the John D. and Catherine T. MacArthur Foundation. On Terra Nova, a Web forum for social scientists who study online worlds, he announced that "nothing worth noting is going to happen for a long time."

The programmers of Whyville have had more success. Launched in 1999 as an education-and-research tool, the free world for 8- to 15-year-olds now boasts 1.7 million users, according to Numedon, Inc., of Pasadena, Calif. Several times programmers have introduced outbreaks of Whypox, which stippled the faces of the users' avatars with red bumps and interrupted their text chats with "achoo, achoo." Yasmin Kafai, a University of California, Los Angeles, education professor who studies Whyville and its users, says that offline, kids vigorously debated the cause of the outbreak and how it spread. "It turned out to be a really good learning tool for the kids," she says.

Social scientists hope that online worlds turn out to be good learning tools for them too. Bainbridge says that "there's a transition in terms of the magnitude of the social phenomenon" of online worlds that will continue drawing researchers. How much useful information the worlds ultimately provide, and their applicability to the offline world, remain open questions. ■



**VIRTUAL PLAGUE** — Bones of characters killed by the viruslike "corrupted blood" epidemic litter the floor of a dungeon in the World of Warcraft. The inadvertent plague, which crippled the hugely popular online world for 5 days, drew attention from epidemiologists who want to insert planned outbreaks into online games to see how players react.

# THE BIG DRY

## Prolonged drought threatens Australia's people, wildlife, and economy

BY EMILY SOHN

Step off a plane almost anywhere in Australia, and one of the first things you'll notice is water—or rather, the absence of it. In every public bathroom in Melbourne, signs remind people to be sparing with the faucet. In Brisbane, short showers are required by law. And throughout southern Australia, everyone using a toilet is supposed to choose the alternate-flush option.

Australia is locked in a drought of drastic proportions. In recent years, rivers have reached record lows. Temperatures have spiked to record highs. Cities are running out of water. Wildfires are burning. Ecosystems are suffering. And climate models are projecting more of the same—and worse—for many years to come.

The Australian continent has experienced dry spells since ancient times, but the length and severity of the current crisis have surprised even the most weathered climate experts. Australia's population has grown rapidly in recent decades, and there just isn't enough water to go around anymore.

"This is probably the worst drought that's been experienced in Australia since colonization by Europeans," says Hamish McGowan, a climatologist at the University of Queensland in Brisbane. "All of a sudden, the desert has come to town."

As climate experts struggle to apportion blame between natural cycles and human activities, technology-minded researchers are looking for innovative ways to keep Australia's taps flowing. Their struggle may provide important lessons for the rest of a warming globe.

"What has shocked Australia is that we've been managing our dams and water-allocation systems as if ... it would keep on raining," says Mike Young, professor of water economics and management at the University of Adelaide. "We haven't prepared ourselves for a massive [climate] shift."

**PARCHED** The Big Dry, as Australians have taken to calling it, has hit three parts of the country especially hard. The southwestern corner of Australia around Perth, the state of Victoria in the continent's southeast corner, and the area around Brisbane on the east coast have seen 15 to 20 percent declines in precipitation over the past decade or so, says David Jones, head of

climate analysis at the Australian Bureau of Meteorology's National Climate Centre in Melbourne.

What's more, every 10 percent decline in precipitation leads to a 30 to 40 percent decline in the amount of water that runs off land into streams and rivers, Jones says. The runoff recession has greatly reduced the amount of usable water ending up in catchments, reservoirs, and dammed lakes.

The Murray-Darling River Basin—Australia's agricultural heartland—is an area of particular concern. Stretching across southeastern Australia from Brisbane to Adelaide, the million square kilometers of the basin make up just 14 percent of the country's area but account for 70 percent of its water use for crop irrigation.

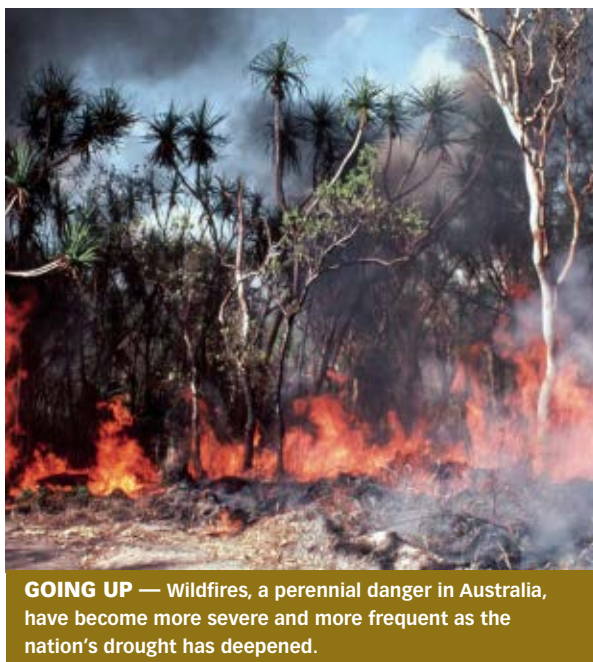
Also called Australia's food bowl, the Murray-Darling River Basin produces some 40 percent of the nation's agricultural products, including grapes, cotton, rice, and dairy. Two million people live within the basin, and another million on the outskirts depend on it for drinking water, especially during dry times.

The region's water supplies are rapidly becoming less dependable, however. By the end of August this year, the amount of water stored in the basin's reservoirs and lakes was about 2,000 gigaliters (GL)—21 percent of capacity, according to a government report. A year earlier, stored volume was 3,610 GL, while historically, stored volume at the end of August has averaged 6,690 GL, or 71 percent of capacity.

Even though rainfall has been up in recent months, the 2006–2007 growing season was the basin's driest in the 116 years for which

records exist, according to an August 2007 report by the Murray-Darling Basin Commission. Computer models that predict weather patterns give a 75 percent chance that storage levels will remain low through May. "The system is really running on empty," Young says. "We're now borrowing water from the future."

Yet the future is not looking very wet either. Rainfall in Australia will drop by as much as 10 percent by 2030 and up to as much as 30 percent by 2070, according to predictions released this month by the Australian Bureau of Meteorology and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), a government agency headquartered in Canberra. And a report from the United Nations' Intergovernmental Panel on Climate Change (IPCC) in February predicted that by 2050, annual river flows in the Murray-Darling Basin are likely to fall by between 10 percent and 25 percent from their current depleted amounts. As early as 2020, the relatively stagnant water in the basin is



**GOING UP** — Wildfires, a perennial danger in Australia, have become more severe and more frequent as the nation's drought has deepened.



expected to become too salty to be safe for drinking and irrigation. “Even if we get fabulous rains this spring and summer,” Jones says, “it’s only going to make a token of a difference.”

It’s likely to get hotter as well as drier, says climate scientist Neville Nichols of Monash University in Melbourne. Australia’s average annual temperature has risen 0.7°C since 1950, according to a recent IPCC report. Recent drought years have all set record-high temperatures, Nichols adds. And temperatures over the continent are expected to rise between 1° and 5°C by 2070, depending on the extent of the world’s increase in greenhouse-gas emissions, according to the recent CSIRO report.

With so much persistent dry heat, bushfires are on the rise throughout Australia. Massive wildfires during 2 of the past 5 years have burned about one-third of forests in Victoria. Besides killing trees and wildlife, these burns leave a litter of downed logs that can clog dams and rivers when rains do come. “It’s sort of a biblical script at times,” Jones says. “We have a drought followed by severe bushfires followed by severe floods. That kind of compounding is going to happen increasingly under global warming.”

**WHY SO DRY?** Disentangling the numerous factors contributing to Australia’s extended drought is difficult for a continent that has experienced dry spells for a long time.

Over the past few million years, dry times have alternated with wet times in Australia. During glacial periods that last for hundreds of thousands of years, the continent tends to be dry. Shorter interglacial periods, like the one Earth is in now, are relatively wet because less water is tied up in ice.

“The scary thing ... is that [Australia is] much drier during this interglacial period than during the last interglacial period,” says Gregory Webb, a geologist at the Queensland University of Technology in Brisbane.

On top of those long-term trends, every 4 to 7 years, Australia also experiences dry spells that typically last 12 to 18 months. Each such episode is driven by an El Niño, the periodic but irregular warming of tropical waters in the eastern and central Pacific Ocean. Cooling of the same waters is called a La Niña. “Australia has a climate that is heavily driven by El Niño and La Niña cycles,” says Andy Pitman, codirector of the Climate Change Research Centre at the University of New South Wales in Sydney.

In a phenomenon known as the El Niño–Southern Oscillation, changing ocean temperatures alter atmospheric-circulation patterns and influence the weather on both sides of the Pacific Ocean. El Niños typically make Peru and Ecuador much wetter than normal, while leaving Australia hot and dry.

On average, an El Niño brings drought to eastern Australia 5 out every 20 years, Pitman says, allowing affected regions to recover between dry times. Over the past 25 years, however, repeated, strong El Niños have dominated the Pacific. Some measurements indicate that a La Niña will return this year, bringing much-needed rain, but it’s impossible to tell how many more could follow. Whether global climate warming bears the blame for the recent surge in El Niños is a question that scientists haven’t yet settled.

Still, no discussion of Australia’s water crisis can neglect the possible influence of global warming. “There is very strong consensus among nearly all [global-climate] models saying that if you increase greenhouse gases, you get the decline in rainfall [in Australia] that we’ve seen over the last 10 to 30 years,” says Nichols.

Human activity of another kind, land clearing, may also have exacerbated the drying trend in eastern Australia. In an upcoming *Geophysical Research Letters*, climatologist McGowan presents results from climate models suggesting that clear-cutting for agriculture has led to a measurable rise in temperature, a drop in rainfall, and a reduction in soil moisture in several parts of Australia—notably the Murray-Darling Basin.

The principle is simple, McGowan says. If you stand under a tree on a sunny day, the air feels cool and humid. If you walk into a clearing, you encounter a dryer, hotter microclimate. “You can imagine what happens if you clear hundreds of thousands of hectares,” he says. “We are starting to see now that human activity is having a quantifiable effect on the severity of drought.”

However, the picture is murky and confusing, experts say, and the nuances are too confusing to allow simple conclusions.

**RIPPLE EFFECTS** Twenty-one million people live in Australia. Nearly 90 percent of them live on the coasts, and most are concentrated in the nation’s five largest cities—Sydney, Melbourne, Adelaide, Brisbane, and Perth. Nationwide, the population has increased by nearly 25 percent since 1990, and cities have been growing rapidly. Drought now affects the daily lives of most Australians.

Rules govern water use throughout the dry zones. Brisbane, Australia’s third-largest city with 1.8 million people, has some of the country’s toughest rules. Lawns can be watered only for a few hours every other day, and only with a tap-filled bucket or can. Forget about the drive-through car wash: Residents can scrub only their vehicles’ windows, mirrors, and essential working parts. Four-minute showers are recommended to avoid fines for exceeding an 800-liter-per-day limit for each household. The average American single-family household, by the way, uses 1,325 liters—350 gallons—of water a day.

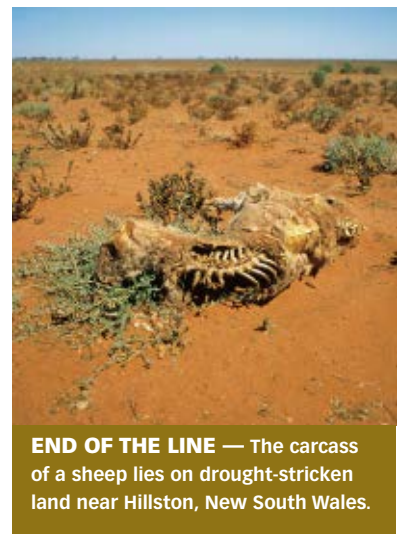
People aren’t the only ones feeling the heat. Wildlife appears to be suffering too. That’s extreme news, considering that much of Australia’s fauna has evolved to cope with long dry spells.

A pregnant kangaroo, for example, can delay the birth of her young for months in case drought strikes. And many of Australia’s birds and mammals extract all the moisture they need from leaves. Adaptations such as these have allowed animals to survive dry times and bounce back quickly when wetter weather returns. Now, however, development has drastically reduced the population sizes and habitat buffers that helped animals survive droughts in the past.

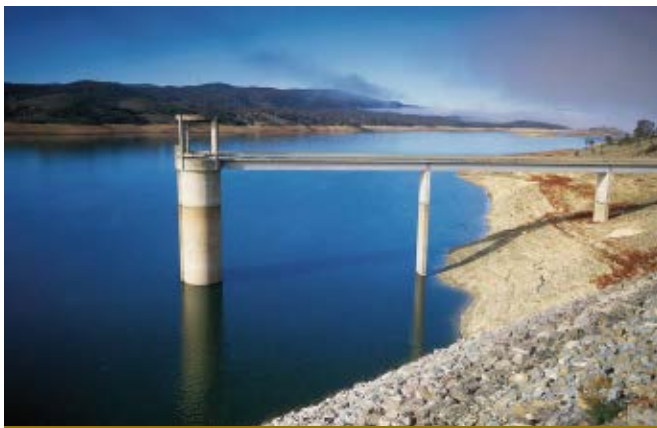
Koalas are in big trouble in some areas because drought is killing off several species of eucalyptus trees, the animals’ main food source. Koala ecologist Alistair Melzer of the Central Queensland University in Rockhampton recently conducted an informal survey of a well-studied population of koalas in central Queensland. As many as 50 animals per square kilometer used to show up in similar searches. This time, Melzer found signs of koalas but no actual koalas. Throughout the



**FOOD BOWL —** Agriculture in the Murray-Darling River Basin depends heavily on irrigation.



**END OF THE LINE —** The carcass of a sheep lies on drought-stricken land near Hillston, New South Wales.



**GOING DOWN** — Australia's prolonged drought has markedly restricted the country's water supply. This depleted reservoir is on the Molonglo River in New South Wales.

region, he says, property owners have increasingly reported dead and disappearing koalas over the past decade. As eucalyptus forests change, Melzer says, other animals that rely on those trees will suffer, too, including a wide range of possum species.

To predict how animals and ecosystems will—or will not—cope with an increasingly dry future, scientists are looking deep into the past. About 45,000 years ago, for example, 90 percent of Australia's large mammals disappeared, including carnivorous, 200-kilogram kangaroos, marsupial lions, and flightless birds that weighed more than a ton.

Some evidence connects this rapid, continentwide megafauna extinction with the arrival of humans on the continent (*SN*: 1/20/07, p. 38), but scientists have also proposed that a major drought might have caused the die-off. In the *Australian Journal of Earth Sciences* last year, and in several papers soon to be published, geologist Webb and his colleague Gilbert Price of the University of Queensland report their studies of an area of southeast Queensland called the Kings Creek catchment. Their data show a long, gradual decline of both large and small animals, with no signs of hunting. Moreover, the extinctions coincided with a transition from lush forests to dry grasslands. "We interpret this to mean that aridification caused extinction," Webb says, acknowledging that the conclusion is controversial.

Figuring out such scenarios could help scientists find ways to avert the same catastrophes in the future. Pitman cautions, though, that "you've got to be very, very careful what you blame on global warming" or other human-caused phenomena. Crying wolf, he says, could be a disastrous way to undermine efforts to convince policymakers that human-induced global warming is real.

**WHAT NOW?** As scientists sort through the possible causes of Australia's water woes, governments at all levels—from federal to local—are taking action. In Perth, a desalination plant is already turning seawater into drinking water—but using lots of energy to do it. Making major financial investments in an uncertain future, Melbourne and Sydney are planning their own desalination plants. In Queensland, communities are beginning to build wastewater-recycling plants, but that idea has sparked some strong opposition.

At the same time, sophisticated water markets are developing to allow farmers, businesses, and others to buy, sell, and trade access to the precious liquid. "If you want a larger share, you have to buy it," Young says. "The price of water is going up enormously."

Australians are rising to the challenge of living with less water, but they continue to grapple with an environment that they don't recognize any more. "We really will run out of water if it doesn't start raining," Webb says. "It's spooky." ■

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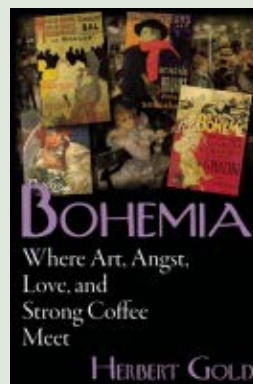
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## ASTRONOMY

### Record-breaking supernova

Astronomers have discovered the most luminous supernova ever recorded. At its peak, the stellar explosion, which erupted in a galaxy 4.7 billion light-years from Earth, was 100 billion times as bright as the sun.

Robert Quimby was hunting for supernovas with a tiny telescope, the 18-inch ROTSE-IIIb at McDonald Observatory near Fort Davis, Texas, when he spotted the explosion. Follow-up observations with the same observatory's 10-meter Hubble-Eberly Telescope hinted that light emitted by doubly ionized oxygen atoms in the supernova was shifted from its normal position in the spectrum to much longer, or redder, wavelengths. This suggestion of high redshift indicated that the supernova, found in 2005 and dubbed SN 2005ap, came from a remote galaxy. It had to be extremely luminous to be seen at such great distances.

"It [was] so luminous that I originally doubted the distance," says Quimby, now at the California Institute of Technology in Pasadena.

A colleague of Quimby's observed the supernova's fading glow with the 10-m Keck I telescope atop Hawaii's Mauna Kea. That spectrum showed emissions characteristic of both redshifted oxygen and magnesium, convincing Quimby that the supernova really is distant. He and his colleagues report the findings in the Oct. 20 *Astrophysical Journal Letters*.

SN 2005ap is classified as a type II supernova, marking the collapse of a massive star. It's about twice as luminous as the previous record holder, SN 2006gy, another type II supernova found by Quimby using the same small telescope (*SN: 5/12/2007, p. 293*). —R.C.

## MATERIALS SCIENCE

### Polymer could improve natural gas purification

Natural gas requires heavy processing to remove carbon dioxide and other impurities before it can be used for fuel. Many processing plants use low-cost polymer mem-

branes to remove carbon dioxide. Researchers have now developed a new polymer with hourglass-shaped pores that can do the job more efficiently than standard polymers do.

Membranes used for gas separation have pores that let through some molecules but not others. However, variations in the size and shape of the pores reduce the membranes' efficiency. Chemical engineer Ho Bum Park at the University of Texas at Austin and his colleagues have designed a polymer with uniform pores.

The hourglass shape of the new polymer's pores mimics that of water channels called aquaporins found in cell membranes. These channels let water molecules pass in and out of the cell while blocking the passage of other molecules. In the new polymer, the pores' large mouths allow large amounts of natural gas to collect on the membrane's surface, while their narrow channels let only small molecules of carbon dioxide slip through, says Park.

The polymer is four times more efficient than conventional polymers at separating out carbon dioxide and a few hundred times faster at letting the smaller gas molecules pass through. Park and his colleagues describe their new plastic in the October 12 *Science*. —A.G.

## MICROBIOLOGY

### Stored blood loses some of its punch

Blood begins to lose nitric oxide shortly after it is drawn from a donor, two new studies show. The loss of this important chemical may explain earlier findings that transfusions seemed to harm rather than help some patients.

Nitric oxide (NO) dilates arteries, facilitating oxygen delivery to the tissues. In both studies, scientists tested stored red blood cells, which carry NO. They found that the cells lost at least 75 percent of their NO within 3 hours of being donated. The concentrations remained low for 42 days, after which stored blood is discarded. The researchers report their findings in the Oct. 26 *Proceedings of the National Academy of Sciences*.

Cardiologist Jonathan S. Stamler of Duke University Medical Center in Durham, N.C., and his team showed that it is possible to put NO back into stored blood. They then compared the effects of depleted and

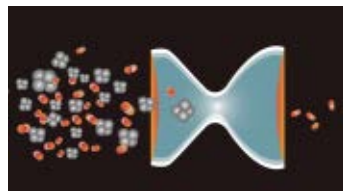
replenished blood on dogs by monitoring blood flow in the animals' hearts. Blood flow was poor in dogs given blood depleted of NO but significantly better in dogs given blood with replenished NO.

Red blood cells change shape to get through narrow vessels. The other study, led by critical-care physician Timothy J.

McMahon, also at Duke, found that deformability declined gradually during the 6 weeks in which blood was stored. Further research will help scientists ascertain whether the decline of NO is linked to the reduction in deformability, says McMahon.

If large trials in people confirm these results,

Stamler says, hospitals should prepare to replenish stored blood with NO. —N.S.



**SAVVY SEPARATION** A polymer membrane with hourglass-shaped pores separates carbon dioxide (orange) from methane (gray).

## SCIENCE & SOCIETY

### Math clubs get national sponsor

To celebrate its 25th anniversary, MathCounts—a middle school math enrichment program—is broadening its outreach. The Alexandria, Va.-based sponsor of local, regional, and national math competitions is launching a program that will give schools free materials to create math clubs for sixth to eighth graders.

Research shows that when U.S. students reach middle school, "they tend to either lose interest [in math] or lose ground and ability compared to counterparts overseas," explains Louis DiGioia, MathCounts' executive director. "Our mission is to increase enthusiasm and achievement for middle school math."

MathCounts has long focused on revving up interest through competitions. Last year, 41,000 middle school students entered at the local level, and winners proceeded to the state and national levels. While continuing these competitions, MathCounts is now adding a new, non-competitive program.

Any U.S. school with grades 6 to 8 may request a "club-in-a-box" package of resources for teachers and students. Monthly challenge problems will appear on MathCounts' Web site. Clubs with at least 12 members who perform well on an ultimate challenge each year will receive a banner, says DiGioia. "We're trying to help make math as important as a school sport." —J.R.

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## IMMUNOLOGY

## Ulcer bug may prevent asthma

Call it a bad-bug, good-bug story. Children whose stomachs carry the bacterium *Helicobacter pylori* are at lower risk for asthma than children who don't have the bug, according to an analysis of a nationwide study.

Starting in the 1980s, *H. pylori* gained notoriety as the cause of most stomach ulcers. The bug also increases the risk for stomach cancer.

Increasing antibiotic use has cleared *H. pylori* from more than 90 percent of children, says Martin Blaser, a physician and microbiologist at the New York University School of Medicine in New York City. But his research shows that this microbial annihilation may carry a price.

In 3,327 children ages 3 to 13, those with *H. pylori* in their stomachs were 53 percent less likely to have asthma than were children who didn't have the stomach bug, according to Blaser's analysis. Being positive for *H. pylori* also decreased the risk for dermatitis, eczema, and bouts of wheezing among the children. The researchers drew their data from the long-running federal National Health and Nutrition Examination Survey.

About 13 percent of children in the United States have been diagnosed with asthma, according to the Centers for Disease Control and Prevention in Atlanta. The disease is a chronic inflammation of the airways thought to be triggered by a malfunctioning immune system.

Blaser says that *H. pylori* colonization may prime the immune system to prevent asthma in some children.

The findings "point toward a much more complex view of the organism—not just as an ulcer pathogen or cancer pathogen, but as an organism that has its costs and benefits to us," he says. —B.V.

## BACTERIOLOGY

## Twice bitten

Second episodes of Lyme disease are probably caused by a second tick bite rather than a return of the original illness, according to a first-of-its-kind study.

Lyme disease is the most common tick-borne disease in the United States, infect-

ing about 20,000 people each year. The disease is caused by the bacterium *Borrelia burgdorferi*, which deer ticks transmit via biting. Victims often develop a distinctive bull's-eye rash.

A monthlong course of antibiotics generally clears the infection, but physicians have reported patients who, after successful treatment, return some time later with another round of symptoms. The physicians wondered whether the return of the illness signaled a relapse of the initial infection.

To find out, Robert Nadelman and his colleagues at the New York Medical College in Valhalla scanned and compared DNA markers in bacteria found in the first and second rashes of six relapsing patients. In all six cases, the bacteria from the first and second bull's-eye carried different DNA.

Nadelman says the findings mean that "recurrent infections are unrelated to the original," and instead arise from a second tick bite. "It appears that even when people have already had Lyme disease, they are not taking sufficient steps to avoid being bitten again," he says. —B.V.

## EPIDEMIOLOGY

## "Knuckle fever" reaches Italy

An exotic virus that debilitates victims with fevers and joint pain has spread from Africa and India to Italy, where it has caused at least 284 cases of illness.

The chikungunya-virus outbreak began in 2004 on Lamu, an island off the east coast of Africa, says Robert Breiman, an epidemiologist at the Centers for Disease Control and Prevention station in Kisumu, Kenya. It soon spread to the nearby Comoro Islands, and "then the bottle really opened up" and the outbreak leaped to mainland Africa and to India.

Breiman and his team estimate that 75 percent of the residents of Lamu contracted the virus. Once the virus is established in an area, "it's almost impossible to escape," Breiman says. On the Comoro Islands, 215,000 people became infected. French authorities reported 266,000 cases on Reunion Island, off Madagascar. There, health officials attributed 255

deaths to chikungunya, although the virus' lethality is debated. People almost never die from it, says Breiman, "although they wish they had."

The crippling symptoms often clear up in a few weeks, but can sometimes linger for months.

First identified in the 1950s, chikungunya means "stooped over in pain" in an African dialect. The illness used to be called knuckle fever, a reference to the swollen joints it can cause.

Mosquito control is the best way to limit outbreaks, says Breiman, but "traditionally, that has been very hard to implement."

Although epidemiologists have not established exactly how the disease spread so widely, Breiman says that it's likely that people infected in one area traveled to another, and then were bitten by local mosquitoes that continued the chain.

Breiman says "the question now is will it continue to spread to other places that have" the right type of mosquito. "And I would think that is likely." —B.V.

## HIV/AIDS

## HIV-positive people getting heavier

Exaggerated weight loss—wasting—used to be a hallmark of HIV infection. With the success of new medicines, however, that appears to be changing. In two hospitals, at least, people with HIV are becoming overweight or obese at the same rate as the U.S. population in general.

A survey of 663 HIV-infected patients at the Naval Medical Center in San Diego and the National Naval Medical Center in Bethesda, Md., found that 63 percent qualified as overweight or obese. When diagnosed with HIV, 46 percent of the study patients were obese or overweight, and 72 percent of all the patients subsequently gained weight.

None of the patients met the strictest definition of wasting. Only 20 patients, or 3 percent, met looser criteria for wasting.

The Centers for Disease Control and Prevention in Atlanta says that 66 percent of the general population is obese or overweight. The CDC defines obesity as having a body-mass index (BMI) greater than 30; people with a BMI between 25 and 30 are classed as overweight.

"I think this is an indication that HIV medications are working, that HIV is now a chronic illness like high blood pressure," says Nancy Crum-Cianflone, the physician who led the study. "Wasting has become extraordinarily rare, at least in America." —B.V.



**HIDDEN BENEFIT** *Helicobacter pylori*, the tube-like bacterium shown here colonizing a human stomach, causes ulcers but also may prevent childhood asthma.



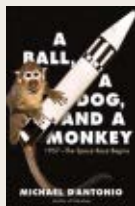
# Books

A selection of new and notable books of scientific interest

## A BALL, A DOG, AND A MONKEY: 1957—The Space Race Begins

MICHAEL D'ANTONIO

This year's commemoration of the 50th anniversary of the launch of Sputnik brings back memories of the enthusiasm and adventure, as well as the paranoia, surrounding the birth of the space race. D'Antonio paints a detailed portrait of efforts by U.S. government and military experts, along with scientists, to catch up with the Russians. The earliest efforts were shrouded in secrecy, but as test rocket after test rocket exploded on the launch pad at the newly established Cape Canaveral, word got out. Soon, the entire country was riveted by the unfolding contest between Russia and the United States to put the first person in space. D'Antonio describes the key players in this drama, including former Nazi rocket chief Wernher von Braun, who had an essential role in the production of a viable American rocket. He also gives due credit to President Dwight Eisenhower, who attempted to temper some of the military hype surrounding the conquering of space, and to the scientists, journalists, and astronauts whose



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work would forever change how we look at space and at our place in the universe. *Simon and Schuster*, 2007, 306 p., hardcover, \$26.00.

## GOOD CALORIES, BAD CALORIES: Challenging the Conventional Wisdom on Diet, Weight Control, and Disease

GARY TAUBES

These days, many people steer clear of high-fat-content foods in an attempt to maintain weight and heart health. But where did this dietary dictum



come from, and, more important, is it correct? As obesity and heart disease reach record levels, could what we've learned about what constitutes a healthy diet be partially to blame? In a revolutionary look at evidence gathered since the 1960s, science writer Taubes reveals that the ever-rising consumption of carbohydrates may be behind the increased prevalence of diabetes, heart disease, and high cholesterol. Obese individuals, he contends, may be better served by carbohydrate-restricted diets. He also posits that the benefits of fiber consumption are overblown. He presents research documenting that the source, rather than the quantity, of calories, has the greater effect on weight. Taubes also challenges the assumption that diet and exercise alone can prevent obesity. In the epilogue, he addresses the need for research into the effects of carbohydrates on health and the elimination of the persistent but unproved beliefs about diet and health. *Knopf*, 2007, 601 p., hardcover, \$27.95.

greenhouse gases such as carbon dioxide and methane has been about 20 times greater. —S. PERKINS

## Pitch out

"Perfect pitch isn't so perfect in many" (*SN*: 9/15/07, p. 173) brought to mind the history of pitch through the centuries. In the 17th century, what is now G sharp was an A. Maybe the "perfect" pitch is somewhere else. **STANTON ALGER**, BAINBRIDGE ISLAND, WASH.

Before the 20th century, the tone that musicians called A ranged widely but was generally between 415 and 432 hertz in frequency. Some people today who play "period" instruments tune them accordingly. Today, 415 Hz is indeed G sharp, and A is 440 Hz. The authors of the study say that this historical movement of A might in part explain why even people with perfect pitch often slip up in identifying G sharp. —N. SEPPA

An alternative test for people with perfect pitch is to give them the name of a tone and ask them to produce it by humming, singing, or whistling. It was always nice to have such a person in our choir when I was in college.

**STANLEY MURPHY**, ZEPHYRHILLS, FLA.

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# LETTERS

## Heated dispute

"It's not nice to fool Mother Nature" (*SN*: 8/25/07, p. 125) states that "an increase in the atmospheric concentration of carbon dioxide, not an increase in solar radiation" is responsible for current global warming. What is the scientific—not political—basis for that remark? **WARREN FINLEY**, LAGUNA BEACH, CALIF.

Increasing solar radiation doesn't affect climate change? Doesn't changing the thermostat change the temperature in a room? **SEAN WALTON**, OREM, UTAH.

In February, the Intergovernmental Panel on Climate Change acknowledged that an increase in solar radiation had generated a slight warming of Earth since 1750 (*SN*: 2/10/07, p. 83). Over that same interval, however, the IPCC reports that warming attributed to human-caused emissions of

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