SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

NOVEMBER 9, 2002 PAGES 289-304 VOL. 162, NO. 19

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charming a lady lizard

nano on-off switch

new uses for anemia drug

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jet set

STREAMS SPEWED FROM A BLACK HOLE

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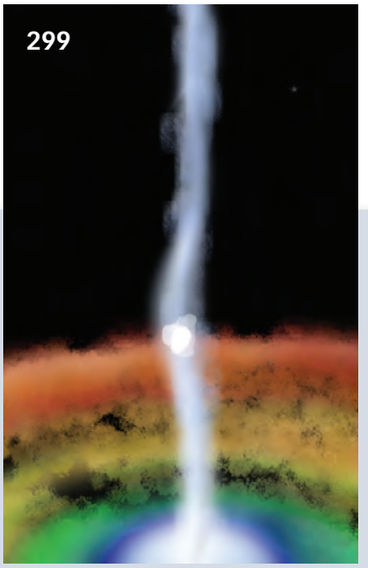

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This Week

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Age limit Eating soy foods won't benefit young women's bones, a new study finds. See Janet Raloff's Food for Thought.

Of Note

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Cover Gas pulled from an ordinary star forms a disk around a black hole in this illustration. The disk's tremendous energies can expel jets of high-speed particles. Astronomers now have observed, over a few years, the emergence of jets and their evolution. (CXC/M. Weiss) Page 299

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Wildfire Below

Smoldering peat disgorges huge volumes of carbon

Once set alight by wildfires, deep beds of decaying tropical plant matter pump massive amounts of carbon into the sky. According to new research, emissions of globe-warming gases from smoldering peat eclipse those from burning surface vegetation and can rival carbon gases produced globally each year by the combustion of fossil fuels.

Disastrous wildfires swept through Borneo and several other Indonesian islands in 1997 and 1998. The flames burned surface vegetation and the peat that's abundant in the region's tropical forests. The fires coincided with a worldwide spike in atmospheric carbon concentrations, prompting scientists to investigate peat's carbon-releasing role.

Using pairs of satellite images taken before and after the 1997–1998 fires, Susan E. Page of the University of Leicester in England and her colleagues examined nearly 25,000 square kilometers of Central Kalimantan province on Borneo. The researchers determined that about 32 percent of the area burned during the fires.

Page and her team then visited 43 burned sites within a section of the study area and directly measured the depth of peat lost. On average, more than half a meter of peat had burned off, they found. From their measurements, the scientists judge that as much as 8 percent of the section's total carbon stored in peat was lost during the fires.

In the Nov. 7 *Nature*, the researchers report that peat combustion in the study area during 1997 and 1998 released between 0.19 and 0.23 billion metric tons of carbon. By contrast, they estimate that burnt surface vegetation of the same area produced just 0.05 billion tons of atmospheric carbon.

The researchers extrapolate that across Indonesia, the 1997–1998 fires released a total of 0.81 to 2.57 billion tons of carbon into the air. That's 13 to 40 percent of the average annual amount produced globally from combustion of fossil fuels.

The finding highlights the neglected role of wildfires as a source of carbon dioxide emissions, says Joel S. Levine, an atmospheric scientist at NASA's Langley Research Center in Hampton, Va. Levine notes that the new estimates of the effects of peat burning on Borneo are consistent with his published calculations based on a different approach. He cautions, however, that it's difficult to accurately extrapolate from findings in a limited area to an entire country, as Page's team has attempted to do.

A separate study reports annual fluctuations in global atmospheric carbon from 1992 to 2000. Tropical fires in 1997 and 1998 account for the largest 1-year rise in carbon emissions, suggest Ray L. Langenfelds of the Commonwealth Scientific and Industrial Research Organisation in Aspendale, Australia, and his colleagues in the Fall *Global Biogeochemical Cycles*.

The impact of the wildfires seems "extraordinarily large" and far-reaching, given that they weren't global phenomena, say David Schimel and David Baker of the National Center for Atmospheric Research in Boulder, Colo., in a second article in the Nov. 7 *Nature*. Nevertheless, they say, the data support the case that local, episodic events can significantly affect atmospheric carbon worldwide.

PAGE AND J. RIELEY

SCORCHED EARTH Flames and smoke rise from a peat forest in Central Kalimantan, Indonesia, spewing the soil's abundant carbon skyward.

If so, the carbon boost from wildfires could reinforce itself. Global warming caused by carbon dioxide and other greenhouse gases may gradually reduce the amount of moisture stored in soils, leaving forests increasingly susceptible to wildfires, Levine says. This fall, severe fires again struck Indonesia, and researchers are already studying the conflagrations' aftermath. —B. HARDER

Nanotech Switch

Strategy controls minuscule motor

Tiny machines need tiny motors. Now, researchers have designed an on-off switch for a motor made from a spinning protein fragment just 11 nanometers wide.

A motor such as this one, based on a natural protein, might someday operate nanoscale machines such as drug-delivery systems, says Carlo Montemagno of the University of California, Los Angeles. He and his colleagues describe their controllable minimotor in the November *Nature Materials*.

The protein that Montemagno and his colleagues used is an enzyme ATP synthase, which produces the cellular fuel adenosine triphosphate. The researchers worked specifically with a spinning fragment of ATP synthase called F_1-ATPase.

Many researchers have been looking at this protein fragment and other spinning proteins with an eye toward using them as motors in future nanoscale machines. Two years ago, Montemagno's team reported that they had attached small nickel and protein propellers to F_1-ATPase hubs that rotate about 8 times per second.

Yet to work in a functioning machine, a motor must be able to turn on and off. In the new work, Montemagno and his coworkers added a zinc-binding site to F1-ATPase. When the researchers then added zinc to a solution containing the modified protein fragment, it stopped rotating. They could restart the F_1-ATPase spinning by removing the zinc with the help of molecules that bind to the metal even more strongly than the protein fragment does.

In contrast, unmodified F_1-ATPase did not stop rotating with the addition of zinc.

The binding of zinc to the researchers' modified protein fragment switches off spinning because "it's like sticking a piece of glue in there," says Montemagno. In other words, the zinc jams up the moving parts.

The switchable minimotor is "taking advantage of a biological system to control mechanical motion," comments James Tour of Rice University in Houston. "To be able

to stop it and turn it back on is really an important thing to do."

There's a long way to go before the nanoswitch can be controlled over numerous cycles of zinc addition and removal, adds Tour, "but it's a step in the right direction . . . . It's a very clever, clever approach."

Any nanotech product eventually developed from this work won't necessarily use F_1-ATPase, says Montemagno, who's working on several nanoscale devices. But the protein fragment is a good experimental model for nature-inspired motors, he says.

The work by Montemagno and his coworkers is bringing closer to reality some ideas of nanotechnology champions, says Peter Satir of the Albert Einstein College of Medicine in New York. On that dream list are cell-repair machines and membranes with nanoscale motors that segregate specific molecules.

Says Satir, "I think you're on your way to engineering these machines that other people have only really dreamt of." —J. GORMAN

Neutron Star Stuff

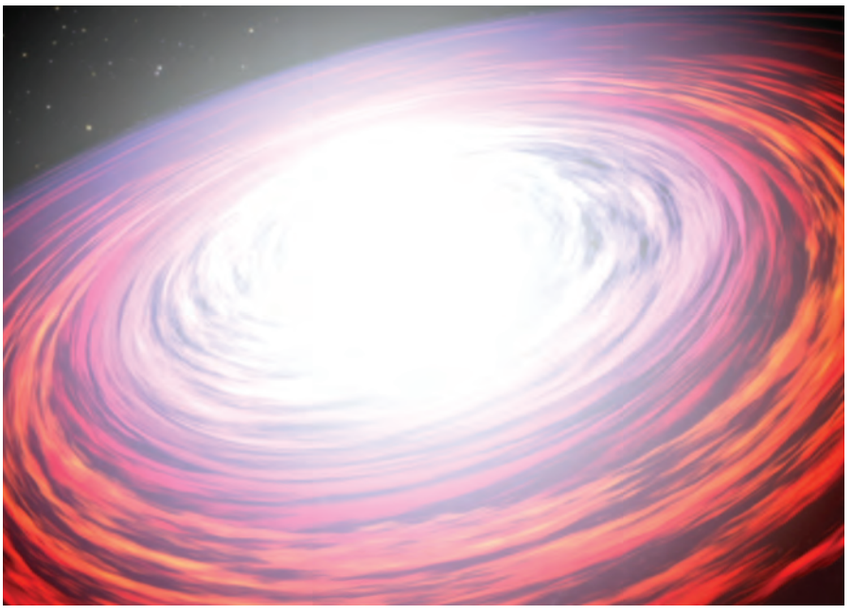
Just neutrons, no quarks

Neutron stars cram more mass than that of the sun into a sphere as wide as a city. A teaspoon's worth of a neutron star weighs in at a billion tons. Exotic though they may be, neutron stars are not what physicists would call strange, according to a study reported this week.

To find out what these ultradense stars are made of, Jean Cottam of NASA's Goddard Space Flight Center in Greenbelt, Md., and her colleagues used an X-ray satellite to determine how light is warped by the extreme gravity of a neutron star partnered with an ordinary star some 30,000 light-years from Earth. This pairing is known as EXO0748-676.

According to the general theory of relativity, light escaping from any strong region of gravity loses energy. The energy loss shifts the light to longer, or redder, wavelengths. Cottam and her colleagues have for the first time measured the gravitational redshift of light passing through the centimeter-high atmosphere of a neutron star.

The redshift induced by the star's extreme gravity depends on the ratio of its mass to its radius. This ratio provides a measure of the star's internal pressure relative to its density. From that number, astronomers can investigate whether the interior of a neutron star is made of just neutrons or includes exotic particles.



EXPLOSIVE FINDING Illustration shows a thermonuclear burst engulfing the surface of a neutron star. Analysis of such bursts reveals the star's composition.

According to a widely accepted model for the structure of a neutron star, its gravity squeezes protons and electrons together to make a compact ball of neutrons. But some scientists have speculated that the neutrons are squeezed further, dissolving into quarks, which are the building blocks of elementary particles. A resulting quark star, for example, would consist of up and down quarks, which make up protons and neutrons, and also strange quarks, which are heavier and not found in ordinary matter.

From their redshift measurements, Cottam's team calculates a mass-to-radius ratio of 0.152 solar masses per kilometer. That ratio is just right if the star is composed of neutrons, but it's inconsistent with the most plausible quark models, say Cottam and her collaborators, Frits Paerels of Columbia University and Mariano Mendez of the SRON National Institute for Space Research in Utrecht, the Netherlands. Their report appears in the Nov. 7 *Nature*.

The findings "look very solid both in terms of the data and their interpretation," says Lars Bildsten of the University of California, Santa Barbara. He adds that the new argument is far more convincing than previous claims that such stars might be composed of quarks. Those conclusions were based on the estimated temperatures of two neutron stars (*SN: 4/20/02, p. 246*).

Even with the high resolution of the European Space Agency's X-ray Multi Mirror (XMM) Newton satellite, Cottam's measurements required the brilliance provided by 28 thermonuclear blasts. These blasts were generated when a critical mass of material from the ordinary companion star piled up on the neutron star's surface. During the blasts, XMM-Newton measured the spectra of X rays passing through highly ionized iron atoms in the neutron star's atmosphere.

Previous attempts to measure a neutron star's redshift focused on a star with an enormous magnetic field. Strong fields, however, induce their own redshift. Since the fields from neutron stars aren't precisely known, the magnetic component of the stars' redshift can't be clearly separated from the gravitational component, notes Cole Miller of the University of Maryland in College Park. In contrast, the object studied by Cottam's team has such a weak magnetic field that its redshift results entirely from gravitational effects. —R. COWEN

Coconspirator?

Genital herpes linked to cervical cancer

Nearly every woman who contracts cancer of the cervix is also infected with the human papillomavirus (HPV). However, many women with HPV don't get cervical cancer. Scientists are trying to figure out why some of these infections lead to the cancer. They now report that if a woman has genital herpes in addition to HPV, her risk of cervical cancer nearly doubles.

HPV is the most common sexually transmitted disease in the United States, infecting roughly 24 million people. The virus comes in more than 60 types, yet most

NASA

HPV infections go unnoticed. Some types of HPV cause only genital warts, or papillomas, which are unrelated to herpes. Two other types, HPV 16 and 18, are linked to cervical cancer.

To probe any herpes-cancer connections, Jennifer S. Smith, an epidemiologist at the International Agency for Research on Cancer in Lyon, France, and her coworkers analyzed blood and cervical cells obtained from women with and without cervical cancer who visited hospitals in Brazil, Colombia, Peru, Spain, Morocco, Thailand, and the Philippines. They ranged in age from 18 to 84, averaging 49 years. Overall, of 1,263 women with cervical cancer, nearly all also had detectable HPV. Of 1,117 women who didn't have the cancer, only 15 percent were infected with HPV.

Smith's team then compared women who were of similar age and had HPV infections of the same type but who differed in whether they had cervical cancer. Of those with cervical cancer, 44 percent had genital herpes. Among the women without the cancer, less than 26 percent had herpes. So, women with cancer were about 70 percent more likely to have herpes than were the other women. The researchers report their findings in the Nov. 6 *Journal of the National Cancer Institute*.

Precancerous sores on the cervix are detectable by a pap smear. If caught early, these lesions can be removed. This often prevents aberrant cells from progressing into a full-blown cancer. Once cancer develops, however, it can penetrate deeper and become far more difficult to treat.

The virus that causes genital herpes can also produce a lesion on the cervix. Although scientists don't know whether there's interplay between the herpes virus and HPV, a herpes infection might rev up HPV growth or help HPV spread deeper into cervical tissue, Smith says. Some scientists have proposed a hit-and-run theory, in which herpes changes some genetic material in a cell and then moves on, leaving it susceptible to further damage from an HPV infection.

Nancy Kiviat, a pathologist at the University of Washington and Harborview Medical Center in Seattle, focuses on chronic inflammation, which has been linked to liver and stomach cancers. "There's a tremendous inflammatory response to herpes," Kiviat says. This may exacerbate the HPV-induced cell damage that leads to cancer.

Moreover, gonorrhea and chlamydia infections, both of which can induce inflammation of the cervix, seem to hike the chance of HPV infections progressing to cervical cancer. Further research into the biological mechanisms by which various infections conspire with HPV to abet cervical cancer may lead to novel approaches for preventing the malignancy, Kiviat says. —N. SEPPA

Lizard's Choice

Mating test pits physique versus domain

When a female moves into her intended's home, is she choosing the guy or his real estate? A novel experiment says that it's the landscaping that counts, at least among side blotched lizards. Moreover, the ladies have their own ways to improve life with a puny gent.

Females of this common Western lizard, *Uta stansburiana*, usually prefer big dominant males, explains Ryan Calsbeek of the University of California, Los Angeles. Those males typically control the best rocks for sun and shade throughout the day, so it's hard to tell what drives a female's decision.

Calsbeek and Barry Sinervo of the University of California, Santa Cruz took rocks from the lizard haves and gave them to the have-nots. Each male, nonetheless, remained loyal to his site. Most females deserted the large dominant males and moved to the better rock collections, Calsbeek and Sinervo report in an upcoming *Proceedings of the National Academy of Sciences*. This is the first experiment in the wild that has differentiated masculine allure from the power of real estate, says Calsbeek.

The researchers found yet another twist in the mating system. The females still visited their previous, studlier partners and, somehow, used their sperm to fertilize eggs that turned into sons. Daughters, however, had received sperm from Mom's smaller rockmates.

PROPERTY PRIORITY A female side blotched lizard perches on prime territory.

CALSBEEK

"These females really can have their cake and eat it, too," says Calsbeek.

Researchers had already established that what makes a territory desirable is its wide variety of rocks. During spring, Calsbeek monitored a group of males, all with blue blotches on their throats, as they staked out their domains. Then he spent a day playing Robin Hood, moving some 1,500 pounds of stones.

Afterward, lizards were in "complete chaos. Everybody was wandering around looking for rocks," Calsbeek says. Out of 51 female lizards that started out in a big male's empire, 37 eventually moved to territories with better rocks. As far as the researchers could tell, most of these new homes had had no female inhabitant because of their pitiful rock supply.

Later, it was easy to recognize and catch females just before they laid their eggs, Calsbeek says. "They looked like beanbags, waddling around on their little legs," he recalls. The researchers brought them into the lab and checked their offsprings' DNA to determine paternity.

Work in progress by Sinervo and Calsbeek suggests a genetic advantage for the lizards' siring pattern. Large males pass on their advantageous size to their sons but handicap their daughters with a tendency to delay egg laying, says Calsbeek.

Research on other animals has turned up evidence that females somehow skew the sex ratio of offspring to fit conditions of greater or lesser food abundance, says evolutionary biologist John Alcock at Arizona State University in Tempe. He calls the newly described sperm allocation "astonishing."

The question of whether rock abundance or male size influences females may pose an artificial dilemma. Mark Elgar of the University of Melbourne in Australia says, "Clearly, it's both." —S. MILIUS

Eye-Grabbing Insights

Visual structure grips infants' attention

Babies take their first major strides with their eyes, not their legs, as they rapidly distinguish among playpens, pacifiers, and a plethora of other objects. These feats of sight draw on infants' ability to keep track of pairs of shapes that regularly appear in the same spatial arrangement, according to a new study.

Sensitivity to such pairings in the visual world provides babies—by 9 months of age—with a foothold for learning to recognize all sorts of items, propose József Fiser and Richard N. Aslin of the University of Rochester (N.Y.) in an upcoming *Proceedings of the National Academy of Sciences*.

"Infants prefer to look at pairs of [shapes] that have frequently co-occurred in visual scenes and may use them to learn about more-complex visual features," the scientists note.

Fiser and Aslin studied 72 infants, all 9 months old. While sitting on a parent's lap,

each child watched a set of randomly displayed scenes on a computer screen. Each scene contained three colored geometric shapes from a pool of 12 shapes. Eight shapes were grouped into four pairs that always appeared in the same arrangement, either one above the other or side-to-side. Each of the remaining four shapes was shown with a specific pairmate, but their relative locations varied from one scene to another.

The researchers presented the babies with an initial series of 16 scenes that was repeated until infant interest flagged. This usually took about seven repetitions. A new trial then presented a series of paired shapes, including the four pairs from the initial trials, shown on a plain background. Babies usually looked much longer at the pairings that had appeared in the scenes.

This result jibes with prior "looking-time" studies, which suggest that infants prefer to look at familiar material after they've tackled a complex task like viewing series of scenes. When faced with simpler tasks, babies look longer at novel stimuli.

In a second experiment, Fiser and Aslin varied the frequency with which specific pairs of shapes appeared in initial trials. In a subsequent trial, infants looked longer at the pairs that they had seen the greatest number of times.

"It's striking that 9-month-olds are exquisitely attuned to the spatial location of items and the frequency with which they occur together," comments psychologist Scott P. Johnson of Cornell University.

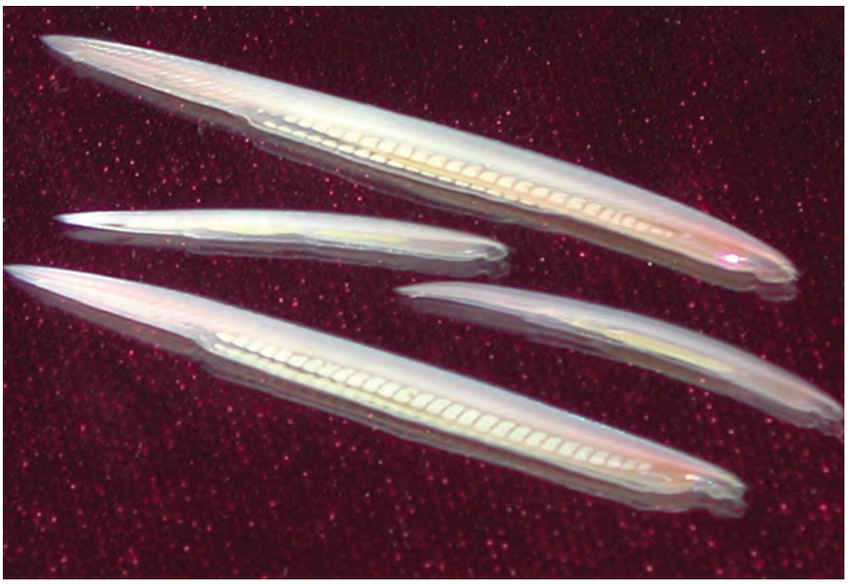
In the March *Cognition*, Johnson and his coworkers reported that infants as young as 2 months apparently recognize a simple and familiar sequence of six colored shapes shown to them earlier. In that experiment, the babies looked longer at novel sequences of shapes than at familiar sequences.

The precise ways in which such visual recognition by infants fosters their learning of different objects in the environment remain unclear. —B. BOWER

First Line of Defense

Hints of primitive antibodies

The lowly lancelet makes a living by burying itself in the sand, sticking out its mouth, and filtering tiny critters from seawater.



EARLY PROTECTION These spineless, 2-to-5-centimeter-long lancelets have only primitive immune systems but may harbor precursors to genes that make antibodies in vertebrates.

C. ANDREWS

Such feeding behavior probably exposes this common marine invertebrate to a wealth of infectious microbes. So, the finger-length animal may require something special in its immune system.

Scientists have now discovered in the animals' guts molecules that resemble the antibodies of more-sophisticated animals. The finding may also offer a clue to how complex immune systems evolved.

Lancelets and other invertebrates wield a primitive, or innate, immune system. It can recognize the creature's own cells and reject foreign bodies. In contrast, people and other jawed vertebrates brandish adaptive immune systems. These can mount tailor-made defensive actions by producing antibodies chemically matched to molecular motifs on invading microbes.

Scientists know little about the emergence of these sophisticated immune systems about 500 million years ago, which occurred as vertebrates evolved from jawless into jawed creatures. "Our adaptive immunity just springs into being," comments Gregory W. Warr, an immunologist at the Medical University of South Carolina in Charleston.

To tease out the details of the transition, other researchers recently turned to lancelets, vertebrates' closest spineless relatives. Molecular immunologist Gary W. Litman of All Children's Hospital in St. Petersburg, Fla., and his colleagues at the H. Lee Moffitt Cancer Center and Research Institute in Tampa used a new technique that identifies short sequences of DNA.

The team scoured the lancelet genome for precursors to a class of genes known as variable-region, or V-region, genes. They're responsible for the enormous range of antibody molecules in adaptive immune systems. No one had unambiguously located such genes in animals more primitive than the jawed vertebrates.

Litman's team found small DNA sequences that resemble V-region genes. The group was surprised to find five distinct families of these sequences.

"We think that we've homed in on gene families that have many characters that are reminiscent of the types of genes that went on to become the diversified families of immune molecules," including antibodies, Litman says. He and his colleagues report their findings in the December *Nature Immunology*.

John J. Marchalonis, a molecular geneticist at the University of Arizona in Tucson, doesn't doubt that these lancelet genes are distantly related to V-region genes. Still, he says, there's no evidence that these genes mix and match, the way true V-region genes do, to encode a huge variety of antibodies. Indeed, the functions of the newly found lancelet genes remain unknown.

Marchalonis says, "It is premature [for Litman's group] to make a strong link with adaptive-type immunity."

Warr contends that the newly identified genes probably do represent the first diversified V-region families to be found in animals more primitive than jawed fish. Says Warr, "There's a possibility that [Litman's team is] looking at a set of molecules that somehow bridge, or are related to, the border between adaptive and innate immunity."

Litman next plans to look for novel immune genes in jawless vertebrates, such as lamprey and hagfish. "We think there is a lot of information buried in the evolutionary history," he says. —C. MARZUOLA

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OLD DRUG, NEW USES?

Anemia drug also protects against nerve damage

BY DAMARIS CHRISTENSEN

Reduce, reuse, recycle. Most people are better at recycling their trash than at either reducing or reusing it. But the idea of turning old products to new uses has a long history—and drug companies are now benefiting from the approach. Testing the safety of drugs in people takes years and can cost millions of dollars. However, research often suggests novel uses for drugs that have been on the market for years.

One of the most recent additions to the list of old drugs with new possible uses is a hormone called erythropoietin, or EPO. It's been used for about a decade to treat anemia in people and, less openly, to boost endurance in athletes. Now, laboratory studies and preliminary trials in people indicate that EPO may be useful in treating nerve damage caused by stroke and spinal cord injuries.

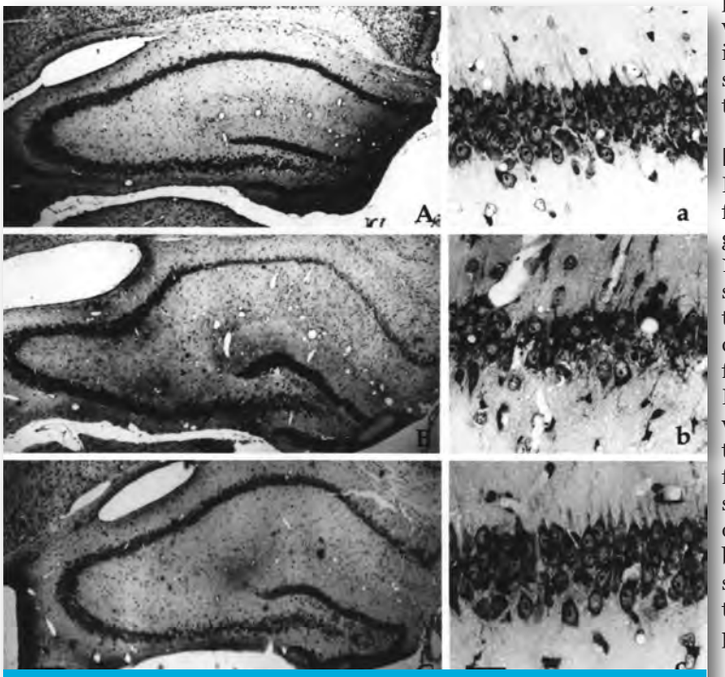
The drug speeds formation of iron- and oxygen-carrying red blood cells. The body naturally increases its production of EPO to compensate for a shortage of oxygen, whether from high altitudes, breathing problems during sleep, or lung disease. Doctors use EPO to treat people suffering from anemia, a condition in which patients have fewer red blood cells than normal. Athletes use EPO because extra red blood cells can carry additional oxygen to hard-working muscles during exercise.

The hormone is made primarily in the kidneys. Just a few years ago, though, researchers found signs that EPO is also made by cells in the brain and spinal cord. The researchers guessed that, as in the rest of the body, EPO might help protect nerve cells against a lack of oxygen. Of all the tissues in the body, active brain tissue uses the most oxygen.

Indeed, research shows a beneficial effect of added EPO on nerve cells. It doesn't, however, act primarily to increase red blood cells around them. The hormone seems to prevent healthy nerve cells from dying in response to signals sent by damaged nerve cells. That's important because in both stroke and spinal cord injury, signals from acutely injured nerves send other nerves into death spasms. This effect accounts for most of the ultimate damage from those traumas.

Scientists are still trying to tease out the variety of pathways through which EPO protects nerves. Even without that information, the researchers are excited about using the drug to treat often-crippling neurological ailments.

"There's a great need for drugs that can protect against nerve damage," says Anthony Cerami of the Kenneth S. Warren Laboratories in Tarrytown, N.Y. "Most neuroprotective drugs fail because of side effects. We already know EPO is safe and well tolerated in people. I think the life that it will have as a tissue-protecting factor is at least as extensive as the life it has had as a treatment for anemia."



BRAIN BENEFITS — Cross-sections of gerbil brains at low (left) and high (right) magnification give a graphic illustration of EPO's benefits. No damage is seen in an animal given a fake operation (top), but blocking blood flow to the brain results in significant cell damage (middle), which can be reduced by injections of EPO (bottom).

SASAKI/PNAS

HEAD TO THE BRAIN

Interest in new applications for EPO took some time to gain momentum. In the early 1990s, a team of Japanese scientists unexpectedly identified EPO-producing brain cells called astrocytes. At first, says lead researcher Ryuzo Sasaki of Kyoto University, "I was quite doubtful that EPO had a physiological function in the brain." But he says that further studies by other teams showed that brain cells have docking spots for EPO, suggesting that the compound must play some natural role.

Sasaki and his colleagues hypothesized that the hormone might affect how brain cells respond to insufficient oxygen. In many strokes, an oxygen deficiency—such as that caused by a clot cutting off blood flow—typically causes some nerve cells to die. Over the next few hours, nearby cells die in response to distress signals that had been sent from the oxygen-deprived cells.

The researchers showed that injecting EPO into gerbil brains protected cells from dying after an animal's blood flow to the brain was temporarily blocked. Further, agents that soak up naturally produced EPO made cells in the gerbils' brains dramatically more sensitive to low oxygen concentrations. That finding

implies that EPO normally plays an important role in minimizing nerve damage, he says.

Sasaki's team injected EPO directly into the brain because few hormones or other large molecules can cross the blood-brain barrier, a tight network of cells along blood vessels that limits which molecules cross from the blood into the brain and spinal cord. However, Cerami and his colleagues, who were studying other actions of EPO, wondered whether the hormone might be among the molecules that the body specifically pumps across the blood-brain barrier. They had found that when healthy animals had the drug injected into their abdomens, they learned new tasks faster and remembered old tasks better than did animals that didn't get EPO.

Cerami reports that high doses of EPO injected into the rats' bloodstream guards the animals against brain damage caused by temporarily obstructing the blood vessels in the brain. "We can protect against about 90 percent of the cell damage in the brain" by administering EPO before or up to 3 hours after inducing strokes in the rats, Cerami says. The hormone also seems to reduce inflammation near the injury, which can further damage nerve cells.

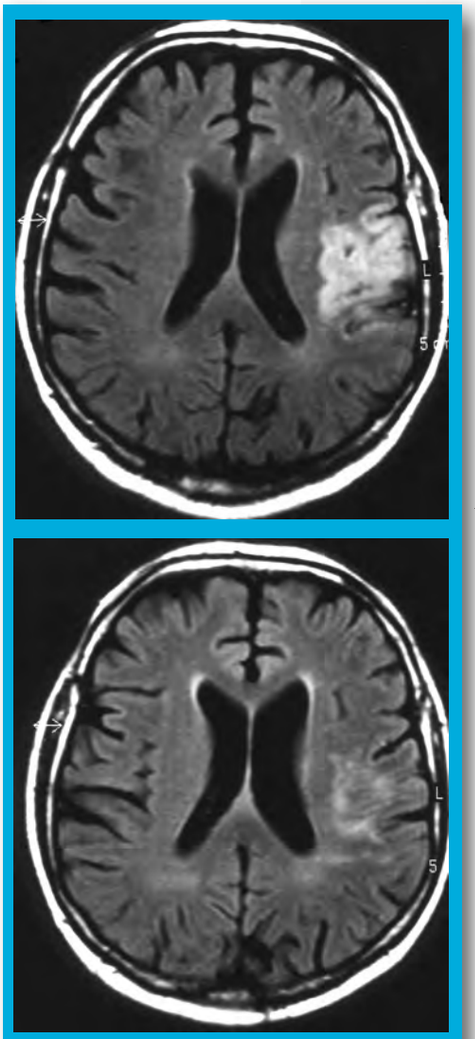
When it was given up to 6 hours after the rats suffered strokes, EPO protected nerve cells from the secondary cell damage, albeit not as well, Cerami says. That long period of effectiveness is appealing because many people who have suffered strokes take several hours to arrive at hospital emergency rooms. Thus, they're not eligible to get the only drug currently on the market that can reduce brain damage from stroke. This clot-busting drug, called tPA, must be given within 2 to 3 hours of a stroke's onset.

In a small pilot study of people with stroke in Germany, 20 patients treated with EPO within 7 hours of stroke later had fewer physical, speech, and memory problems and needed less day-to-day assistance than did 20 who didn't get the hormone. People treated with EPO also tended to have smaller areas of damaged brain tissue, as measured by brain scans a month after their stroke.

People who have had the most-severe strokes seem to benefit most from treatment with EPO, reports Hannelore Ehrenreich of the Max-Planck-Institute for Experimental Medicine in Göttingen, Germany. She and her colleagues published their findings in the August *Molecular Medicine*. The German team is now developing a trial of about 500 patients at several medical centers.

"I think this is a stunning result," says J. Donald Easton of Rhode Island Hospital/Brown University School of Medicine in Providence. "There are fates worse than death, and the disabling consequences of stroke may be one of them."

At least at this early stage in the evaluation, the benefits from EPO for stroke appear to be at least equivalent to that of tPA, Easton says. However, unlike tPA, which poses life-threatening risks of hemorrhage and thus can only be given in hospitals, EPO may be safe enough for potential stroke patients to get the drug on their way to the hospital, he adds. Since the two drugs work in different ways, physicians might also combine them.



BOOSTING IMPROVEMENTS — Brain scans taken 3 days (top) and 18 days (bottom) after stroke in a person treated with EPO. Damaged regions are in white. While almost all patients who have stroke improve with time, stroke patients given EPO showed greater improvements than people who did not get the experimental drug.

EHRENREICH

MOVING ON Though less common than stroke, spinal cord injuries can be devastating—the 11,000 people who get these injuries each year in the United States tend to be decades younger than stroke patients and are typically severely disabled for the rest of their lives. In most cases, people with spinal cord injuries lose control of whatever muscles are linked to nerves coming off the spinal cord below the damaged point. There are no widely effective therapies to repair spinal-nerve damage, though very high doses of steroids have helped limit it in some patients.

Cerami and his colleagues looked first at an infrequent type of spinal cord injury, one that's similar to stroke. If blood flow to the spinal cord is blocked—say, during abdominal surgery—paralysis may result. In the Feb. 19 *Proceedings of the National Academy of Sciences*, the scientists described an experiment in which rabbits received an injection immediately after surgery that blocked blood flow to the spinal cord. Animals given EPO had better muscle control of their hind limbs than did rabbits getting saline instead of the hormone. Over the next 2 days, muscle function worsened in the saline-treated animals, but the EPO-treated rabbits improved. At the end of that time, they also showed less nerve damage than did those that got injections of saline.

In the July 9 *Proceedings of the National Academy of Sciences*, the researchers demonstrated that EPO counteracts the nerve damage associated with two more common kinds of traumatic spinal cord injury in people. In rats with spines damaged by compression of the nerves, a single dose of EPO after injury boosted the animals' hind leg movements within 12 hours of the injury compared with those of rats getting placebo injections. After 28 days, the EPO-treated rats—some of which were given additional doses on the second and third days after injury—had near-normal movement of their hind limbs, Cerami says, while animals given the dummy injections were still paralyzed.

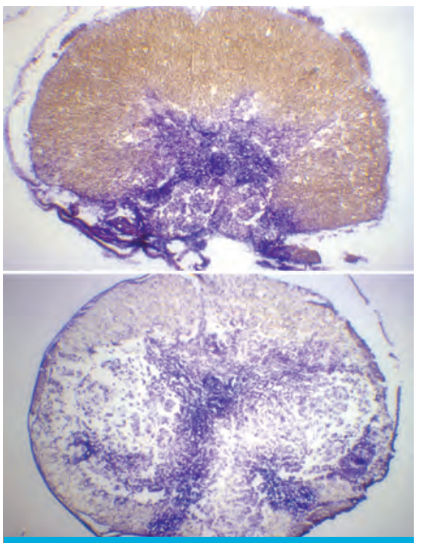
The researchers also examined direct trauma to rats' vertebrae and spinal cord that caused injuries and paralysis more severe than those resulting from compression. The researchers didn't see any recovery of muscle movement or limb function in this group at first, whether or not the animals were given EPO. However, between the 4th and 12th day after injury, animals treated with one dose of EPO an hour after injury had better muscle tone and more coordinated leg movements and were also better at swimming than rats treated with a placebo were. When the researchers examined the rat spines 28 days later, the rats given EPO showed fewer signs of swelling and cell death surrounding the injury than placebo-treated rats did.

"I haven't seen anything [else] that has yielded effects this strong," says Steven A. Goldman of the Weill Medical College of Cornell University in New York City. Finding a benefit from EPO in a variety of spinal cord injuries is "very encouraging" and suggests the hormone could produce similar results in people, he adds.

Nonetheless, Goldman cautions, "even where things work wonderfully in animal models, it's not uncommon to fail in

human trials."

"You can always be fooled, so it's important that other groups replicate these results," says Ron Cohen, president of Acorda Therapeutics in Hawthorne, N.Y. That said, the magnitude of the effect of EPO on rats' spinal cord injuries is impressive, he remarks. People with spinal cord injuries would benefit from even slight lessening of their nerve damage. "If you could just give them a little function, in many cases that could be the difference between sitting in a wheelchair and being able to feed yourself versus being in bed and dependent on others," Cohen says.



SPINE FINDINGS — Sections of spinal cord from injured rats show that those treated with EPO (top) had less nerve damage than did rats that didn't get the hormone therapy (bottom).

M. BRINES/ PNAS

APPLICATIONS ABOUND Even as researchers are examining basic questions about how the hormone crosses the blood-brain barrier and exploring the multiple actions through which it might exert its beneficial effects, they're already pursuing EPO's potential for treating several additional diseases.

Researchers are concerned about potential problems with using the drug to treat chronic diseases. One recent study has suggested that in rare instances the genetically engineered EPO may cause a person's body to stop producing red blood cells at all, perhaps by causing the immune system to attack both the genetically engineered and normal EPO. In people without underlying anemia, long-term therapy with EPO could conceivably increase the number of red blood cells and thus trigger blood clots. However, most doctors say this side effect can be easily monitored and treated by simply removing blood from a patient with too many red blood cells.

Researchers are already looking into whether EPO might offer benefits to people with multiple sclerosis, glaucoma, and heart disease. Cerami and Pietro Ghezzi of the Mario Negri Institute of Pharmacological Research in Milan report in the Oct. 11 issue of *Brain Research* that giving EPO to rats with experimentally induced multiple sclerosis reduces symptoms of the disease.

In the Aug. 6 *Proceedings of the National Academy of Sciences*, a team of researchers including Cerami reports that EPO may protect against the damage caused by glaucoma—a leading cause of blindness. In glaucoma, high inner-eye pressure blocks blood flow to the optic area and damages cells important to vision.

Cerami says he also has unpublished data suggesting that EPO improves outcomes in animal models of heart attacks, which cause widespread cell death and inflammation.

The hormone may also have applications in infant care. When babies don't get enough oxygen during birth, some die and many have lifelong neurological problems. Sandra E. Juul of the University of Washington in Seattle is beginning studies to see whether EPO can benefit these babies.

These projects all contribute to a groundswell of scientific interest in studying EPO's mechanisms and effects. Says Juul, "This is not a silver bullet, but it may be better than what we have, because we don't have anything. I'm very excited about the possibilities." ■

JET ASTRONOMY

Tracing the fire from black holes

BY RON COWEN

Jets of high-speed particles riddle the celestial canvas. They are generated by dramatically different objects: nascent stars still in the process of coalescing, massive stars that have collapsed to form the smallest of black holes, and supermassive black holes weighing as much as a billion suns. Astronomers have long dreamed of having one theory that could explain the origin and evolution of all these jets. New observations are bringing that vision one step closer to reality. For the first time, scientists have traced the slowing and dimming of X-ray–emitting jets from a small black hole. Monitoring the jets with the orbiting Chandra X-ray Observatory over the past 2 years, researchers have viewed the jets as they traveled at half the speed of light, slowed down, and faded.

The jets emanate from the region surrounding a small black hole within the Milky Way that is about 10 times as massive as the sun. Compared with supermassive black holes, which can weigh as much as a billion suns and last millions of years, small black holes have a limited fuel supply and their jets have a much shorter lifetime.

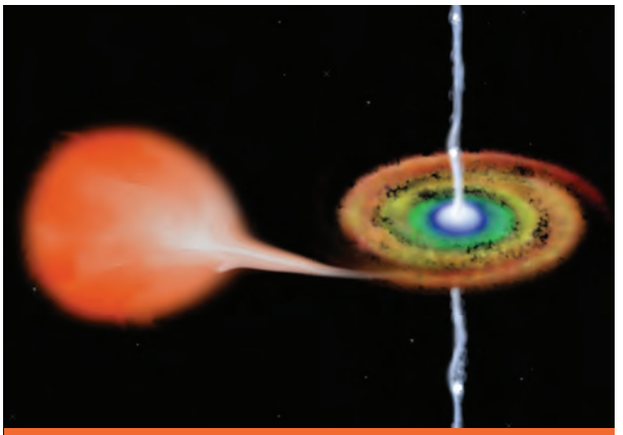
"We watched, in a few years, developments that would have taken thousands of years to occur around a supermassive black hole in a distant galaxy," says Stephane Corbel of the University of Paris VII and the French Atomic Energy Commission in Saclay, France. Corbel and his colleagues report their findings in the Oct. 4 *Science*. They also describe details of their study in two upcoming articles in the *Astrophysical Journal*.

The observations, Corbel notes, are like a time-lapse movie of the evolution of the jets. Moreover, theorists have calculated that the processes producing the jets from small, nearby black holes are the same as those that generate longer-lived, higher-energy jets associated with more-distant supermassive black holes, notes astronomer Cole Miller of the University of Maryland in College Park. The brilliant beacons whose radiation streams out of faraway galaxies are known as quasars.

Corbel's team relied on Chandra and radio telescopes to study two jets shooting out in opposite directions from a double-star system that lies in the Milky Way some 17,000 light-years from Earth. Scientists have classified one member of this stellar partnership as a black hole, the ultimate ember of a long-dead star; the other is an ordinary star from which the black hole steals matter.

Though smaller and more rapidly changing, the jets of this system resemble those emanating from much bigger black holes. In fact, because these jets form and fade over just a few years, they can serve as a Rosetta stone for deciphering the evolution of quasars, which would take thousands of generations of astronomers to directly observe.

JET SPOTTING Observations of the jet-emitting black hole began in 1998, when the Rossi X-ray Timing Explorer (XTE) spacecraft detected an X-ray flare from this stellar system. The flare, which lasted for a day, was a sign that the system's black hole had been dining voraciously on its companion star. As gas from the companion star spirals onto the so-called accretion disk surrounding the black hole, the material emits X rays and other radiation.



HOLEY JETS — Artist's conception of a sunlike star (left) orbiting a black hole (right). As the black hole pulls gas from the star, the material forms a disk heated to millions of degrees. Some of the energy may be emitted as jets perpendicular to the disk.

CXC/M. WEISS

In a process that's still not well understood, jets may also shoot out from the vicinity of an accretion disk. Twin jets emitting radio waves, each moving in the opposite direction, were found within 4 light-days of the black hole just days after the observation of the flare.

Astronomers theorize that the accretion disk sculpts the jets. According to this scenario, energetic particles spewing outward from the neighborhood of the black hole take the path of least resistance. Rather than plowing through the material of the accretion disk, these particles shoot out as twin beams perpendicular to the disk's plane.

Corbel and his collaborators, who include John Tomsick of the University of California, San Diego and Philip E. Kaaret of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., became interested in the stellar system XTE J1550-564 when XTE observations earlier this year recorded new X-ray activity. The team then examined the black hole system with a radio telescope, the Australia Telescope Compact Array in Narrabri, and searched for the system in X-ray images taken by Chandra.

The team found a pair of oppositely directed X-ray jets about a light-year away from the location of the radio-wave jets detected by other researchers in 1998. Corbel's team compared X-ray images taken by Chandra in 2000 with new images from last March and June. A component of the motion of one of the jets points toward Earth, while the other jet is moving away from Earth. During the 2 years between the Chandra observations, the X-ray jets moved about 3 light-years apart and both gradually decelerated. The 2002 images show hot spots, which represent places where the jets have

slowed and given up energy as they crash into dense interstellar gas.

The gradual slowing of the jets, the distance they've traveled, and the relatively recent development of X-ray hot spots suggest that for most of their journey, the jets have passed through remarkably low-density regions of space, comments Michael P. Rupen of the National Radio Astronomy Observatory in Socorro, N.M. Following the stellar collapse that formed the black hole, a massive wind may have cleared out material, creating a virtually empty bubble, he suggests.

In most other systems that astronomers have observed, X-ray jets shoot out and fade without gradually decelerating, Rupen says. If there were much of anything in the vicinity of XTE J1550-54, its jets would have immediately slowed down and shown the hot spots seen in jets from supermassive black holes. These larger jets shoot out from galaxies into the intergalactic medium.

BLIND SPOTS Although the theory of general relativity holds that a jet moving toward Earth at a substantial fraction of the speed of light should appear brighter than its equal but oppositely directed counterpart, just the reverse shows up in the Chandra images.

One explanation is that the black hole has poured more energy into the jet headed away from Earth. Another possibility is that this jet, once it journeyed past the low-density region surrounding its parent black hole, encountered a denser interstellar medium than did the jet that's getting closer to Earth. That would have caused the jet moving away from Earth to radiate more X rays. The cometlike shape of this brighter jet suggests that it is indeed interacting strongly with the interstellar medium, says Kaaret.

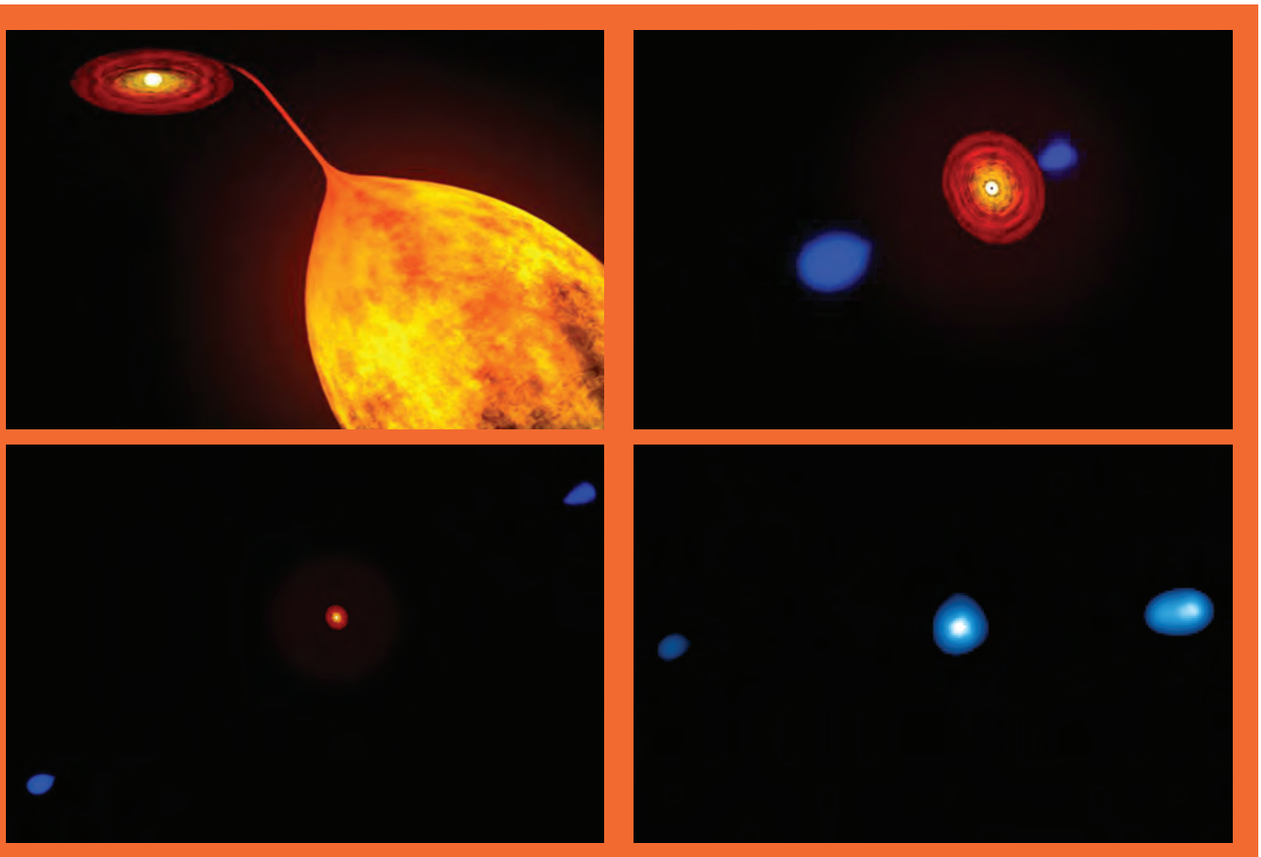
Both jets now have dimmed, and the one pointing toward Earth has all but disappeared. "This is the first time we have observed a jet from the initial explosion until it slowed and faded," says Tomsick.

"Astrophysical jets are an extremely common phenomenon, and they provide a way for us to understand the workings of enigmatic black holes," comments Kimberly A. Weaver of NASA's Goddard Space Flight Center in Greenbelt, Md. "Having a case where we can watch the entire life cycle of the jets is critical to helping us understand jets in general, and this can only be done for these nearly stellar-mass black hole systems."

One thing the new findings don't do, Weaver notes, is to shed light on the origin of the jets. "Unfortunately, we didn't actually see the jets being produced. We saw a bright X-ray flash, which signaled the flaring of the black hole, and then later saw the jets appear far away from the black hole," she says. "We didn't have the opportunity to watch what was happening when the jets were forming close to the black hole."

The observations, notes Rupen, "illustrate the final stages of the rapid evolution [of these jets], as they crash into the interstellar medium, expiring in a blaze of glory only a few years after their birth."

To take pictures of the births of the jets, Kaaret says, astronomers will need to continuously monitor sources like XTE J1550-54 with future X-ray telescopes that are even sharper than Chandra. Such observations, adds Weaver, may reveal the role that a black hole's magnetic field and other features play in the origin and acceleration of the jets. And that in turn may give astronomers the data they need to develop a single theory to explain all the black hole spitfires, from the weakest jets to the most powerful quasars. ■



JET BIRTH — Artist's view of the origin of jets. Top left image shows the double-star system XTE J1550-564—a black hole stealing matter from its companion, an ordinary sunlike star. As gaseous material is pulled off the companion star onto the black hole (top right), it forms a disk that's heated to millions of degrees. Ejection (bottom left) and evolution (bottom right) of two jets (blue) of high-energy particles emanating from the vicinity of the black hole. Images taken last March by NASA's Chandra X-ray Observatory show the black hole XTE J1550-564 (center of lower-right image) and the two jets. In the preceding 4 years, the jets moved about 2 light-years from the black hole.

CXC/A. HOBART, NASA/CXC

OF NOTE

ASTRONOMY

Cosmic rays from the solar system

Dust grains in the outer solar system are the source of some of the cosmic rays that bombard Earth, planetary scientists report in the Oct. 30 *Geophysical Research Letters*. The grains are located in the Kuiper belt, which lies within the solar system beyond the orbit of Neptune and consists of comets and other icy objects from the solar system's formation.

It's the composition of certain cosmic rays that suggests they originate in the solar system, says Nathan A. Schwadron of the Southwest Research Institute in San Antonio. These so-called anomalous cosmic rays are energetic charged particles that strike Earth with only about one-hundredth the energy of cosmic rays from the far reaches of our galaxy or beyond. They consist of carbon, silicon, and iron ions. These ions are common in space between stars, but they would have difficulty penetrating the solar system because the solar wind would repel many of them.

When objects in the Kuiper belt collide, they generate debris ranging from dust grains a few micrometers in diameter to city-size objects, Schwadron notes. As the grains drift toward the inner solar system, they're buffeted by the solar wind. It shakes carbon, silicon, and iron atoms loose from the grains. The atoms become ionized by the sun's ultraviolet radiation and are then accelerated to enormous energies by the solar wind. Some of the ions ultimately bombard Earth, Schwadron and his colleagues calculate.

The discovery that anomalous cosmic rays can be generated from material in the Kuiper belt provides a new tool for gauging the composition and mass of this relic from the solar system's formation, Schwadron says. —R.C.

NEUROSCIENCE

Schizophrenia spurs imaging network

Research into the neural underpinnings of schizophrenia is set to take a big cyberstep forward. A $10.9 million federal grant awarded to scientists at University of California campuses in San Diego and Irvine will be used to create a massive database of brain images from several hundred people with schizophrenia, as well as from a comparable number of individuals with no mental disorders, the two universities announced. The images will come from 10 research sites nationwide.

The pooling of such a vast amount of computerized brain data will give researchers an unprecedented opportunity to share and compare their findings. Scientists coordinating the new brain-imaging network, led by Irvine psychiatrist Steven G. Potkin, will also develop new software to combine and analyze data from different sites.

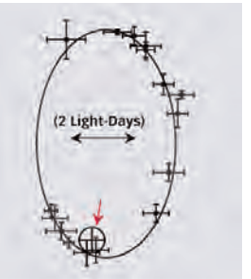
Potkin's group plans to operate the brain-imaging database through a federally funded, high-speed computer network established in 2001 by a group of biomedical-research centers. —B.B.

ASTRONOMY

Milky Way black hole gets real

By tracking a star near the center of our galaxy, astronomers have found the best evidence yet that a supermassive black hole lies at the Milky Way's core. Although observations have long suggested that the galaxy harbors a monster black hole, they didn't conclusively rule out less exotic concentrations of mass (*SN: 9/8/01, p. 148*).

The closest that the star observed by the astronomers ventures to the galaxy's center is a distance three times that between Pluto and the sun. Traveling 5,000 kilometers per second, the star—known as S2—takes a mere 15 years to complete one orbit of the galaxy's core. Researchers now have tracked S2 for 10 years.



HOLEY PATH Orbit of the star S2 indicates that the Milky Way has a black hole at its core.

The star's elliptical path and high speed require the mass at the heart of the galaxy to weigh 3.7 million times as much as the sun, the researchers report in the Oct. 17 *Nature*. "The data no longer allow for a central mass composed of dark stellar objects or a ball of massive [elementary particles]," Rainer Schödel of the Max-Planck-Institute for Extraterrestrial Physics in Garching, Germany, and his colleagues assert.

To distinguish S2 from all the other stars near the Milky Way's crowded core, the team used a powerful technique called adaptive optics. The method measures the amount by which starlight is blurred by Earth's turbulent atmosphere and removes that blurring by commanding a bendable telescope mirror to rapidly change its shape.

"These results are the best evidence yet that supermassive black holes are not just theory but fact," comments Karl Gebhardt of the University of Texas at Austin. —R.C.

BEHAVIOR

Memory grows up in 1-year-olds

The second year of life may be particularly memorable. Around the time of their first birthday, children make dramatic advances in remembering simple events for 4 months after witnessing them, a new study finds. This memory breakthrough depends on a proliferation of neural connections in memory-related brain structures known to develop as infants approach age 1, propose Harvard University psychologists Conor Liston and Jerome Kagan.

The researchers recruited 12 babies and toddlers at each of three ages: 9 months, 17 months, and 24 months. Children watched an experimenter both perform and describe three action sequences. In one sequence, for example, the experimenter said "Clean-up time!" while wiping a table with a paper towel and then throwing the towel into a trash basket.

Kids in the two older groups watched four demonstrations of each action sequence, and 9-month-olds saw six repetitions. After each presentation, the experimenter encouraged children to imitate what they had just seen.

Four months later, the youngsters—then ages 13 months, 21 months, and 28 months—were asked to reenact each set of actions with the same materials after hearing the same verbal descriptions.

The children now 28 months old correctly performed a majority of previously observed actions, usually in their original order, Liston and Kagan report in the Oct. 31 *Nature*. The 21-month-olds reenacted what they had seen almost as well as their older peers did. Far fewer signs of accurate recall appeared in 13-month-olds, the only participants who had been under 1 year of age during initial memory trials. —B.B.

EUROPEAN SOUTHERN OBSERVATORY

OF NOTE

MATERIALS SCIENCE

Worm's teeth conceal odd mineral material

The bite of the common bloodworm, a popular fish bait, hides more than nasty venom. The worm's unusual teeth contain the first known example of a copper-containing mineral in a living organism, researchers report in the Oct. 11 *Science*.

The worm's version of this strong, lightweight copper chloride mineral, known as atacamite, may serve as a model for the design of new synthetic materials, says coauthor Galen D. Stucky of the University of California, Santa Barbara.

Laboratory tests on the jaws of the bloodworm *Glycera dibranchiata* revealed that atacamite's organization makes them durable and flexible. The mineral forms within a protein matrix as fibrous structures about 50 nanometers wide and 500 nanometers long.

Up to 5 percent of the jaw's weight is copper, which is also present there in an unmineralized form, says Stucky. The researchers don't know why such high concentrations of copper aren't toxic to the worm or why the worms have copper in their jaws. They might use the metal to activate their venom or prevent tooth decay, the researchers suggest.

NICE BITE A bloodworm has mineralized copper in its jaw.

Stucky speculates that a synthetic material based on the worm's teeth might one day serve as an antifouling coating for ships' hulls. —J.G.

ENVIRONMENT

Is a faster commute worth it?

People living near major roadways are about twice as likely to die from heart and lung diseases as those who live farther away from such sources of air pollution, according to a new study of almost 4,500 people. The increased risk for people living within 100 meters of a freeway or within 50 meters of some other major road was apparent to researchers even after adjusting the data for the effects of participants' smoking, education, occupation, income, and weight.

"People living at addresses with presumably higher long-term air pollution measures were at higher risk of dying from cardiovascular and respiratory diseases," says Gerard Hoek of the Institute for Risk Assessment Sciences in Utrecht, the Netherlands. The finding, published in the Oct. 19 *Lancet*, fits with other studies that have linked air pollution with increased heart and lung disease (*SN: 1/20/01, p. 39; SN: 7/7/01, p. 9*). No other disease was more common among the 5 percent of the new study's participants living near major roads than among the 95 percent who didn't.

Some of the subjects may have moved from their roadside homes since the ongoing study began in 1986. However, Hoek says most people in the study were unlikely to have done so because they were 55 to 69 years old when the research began, and more than 90 percent had lived in the same house for more than a decade before 1986.

All the participants originally had taken part in a Dutch study of diet and cancer. Hoek and his colleagues plan to study whether the proximity of homes to major roads and deaths from heart and lung disease are similarly linked among the other 116,000 people in the diet study. —D.C.

MEETINGS

E.Hormone 2002
New Orleans, La.
October 17 – 19

ENVIRONMENT

Weed killer feminizes fish

The widely used herbicide atrazine can convert male frogs into hermaphrodites (*SN: 11/02/02, p. 275*). But what happens when a naturally hermaphroditic species, such as the mangrove killifish, encounters this weed killer?

The hermaphrodites can change into females, new data show.

William P. Davis of the Environmental Protection Agency in Gulf Breeze, Fla., and his colleagues put killifish hatchlings in water with atrazine at a concentration of 16 or 33 parts per million for just 5 hours, then raised the fish until they laid eggs.

Ordinarily, these fish develop ovotestes, gonads that make both eggs and sperm. However, 30 percent of killifish exposed to atrazine developed no sperm-producing capacity but still could lay eggs. Davis says this is the first evidence of true adult females in this species.

The finding suggests that atrazine disrupted hormonal cues for testicular tissue. Though mangrove killifish with solely male gonads exist in the wild, they're rare, Davis notes, so the new females' eggs probably would never be fertilized.

DADDY-MOMMY This mangrove killifish makes both sperm and eggs.

The bursts of atrazine exceeded what would ordinarily occur downstream of any farm, Davis notes. His group is now investigating whether longer exposures to more environmentally relevant herbicide concentrations also yield the novel females. —J.R.

TOXICOLOGY

Pesticides block male hormones

Product labels caution people to handle organophosphate insecticides with respect. Although designed to lethally overstimulate a bug's nerves, these chemicals can attack the human nervous system as well. Now, data suggest that these chemicals may also elicit a more subtle toxicity.

Thomas E. Wiese of Tulane and Xavier Universities in New Orleans wondered whether organophosphate pollutants that structurally resemble androgen-blocking drugs also affect people's hormone activity. So, his team did test-tube studies of a host of these pesticides, including fenitrothion, parathion, chlorothion, linuron, and ruelene.

Hormones work by docking with a specific receptor on a cell, which then responds by turning on genes. Though none of the organophosphates bound to cellular receptors for estrogens, the primary female sex hormones, all attached to androgen receptors. However, they didn't turn on genes, indicating that they don't behave like androgens. That may sound like good news, but because the insecticides to varying degrees block access to those receptors, they can interfere with normal gene activation by preventing a natural androgen, dihydrotestosterone, from docking with its receptor. —J.R.

COLLEGE OF ENGINEERING, UNIVERSITY OF CALIFORNIA AT SANTA BARBARA; W.P. DAVIS/EPA

Books

A selection of new and notable books of scientific interest

THE BODY ELECTRIC: An Anatomy of the New Bionic Senses

JAMES GEARY

The convergence of biology and technology is making way for a host of opportunities to repair and even enhance our senses and muscles. Some computers already have the capacity to see, hear, and touch, and a few people have had computer chips embedded in their bodies. For instance, an electrode implanted at the optic nerve of a blind woman with retinitis pigmentosa enables her to see shapes and colors. One researcher implanted a silicon chip in his arm that interacts with electronic devices around him. It transmits a signal that unlocks doors and turns on lights upon his arrival. Other devices allow odors and flavors to be transmitted over the Internet. Some computers act as lie detectors by analyzing facial expressions. Geary explores all these new technologies and their interplay with the mind, which he calls "the sixth sense." He even considers what it might be like to be cyborg. Originally published in Great Britain in 2002. ***Rutgers U Pr, 2002, 214 p., b&w illus., hardcover, $27.00.***

ENVISIONING SCIENCE: The Design and Craft of the Science Image

FELICE FRANKEL

Science photographer Frankel details techniques for presenting compelling images in media as varied as scientific journals, presentations to funding agencies, and popular publications. Addressing scientists directly, she explains how to design and execute effective images using stereomicroscopes, compound microscopes, and scanning electron microscopes on materials big and small. Applying photography principles of light, composition, and focus, she shows how nanocrystals can be arranged in an engaging way and how reflections off a drop of black fluid can become sheer beauty. The text is highlighted by hundreds of stunning examples and detailed instructions. ***MIT, 2002, 328 p., color photos, hardcover, $55.00.***

THE MEASURE OF ALL THINGS: The Seven-Year Odyssey and Hidden Error That Transformed the World

KEN ALDER

While the United States still shuns the metric system, the rest of the world has embraced it for nearly 2 centuries. Alder's compelling story of the rise of the metric system begins during the French Revolution, when measurement systems differed from country to country and in some cases town to town. Scientists dreamed that universal measurement standards would enable better global communication and trade. It was determined that one meter would equal one-ten-millionth of the distance from the North Pole to the equator. But how far was that? Jean-Baptiste-Joseph Delambre and Pierre-François-André Méchain were tasked to figure it out and did so by measuring the meridian arc that runs from Dunkirk through Paris to Barcelona. Alder paints an enchanting portrait of Delambre and Méchain's quest, which took 7 years to complete. Repeating the journey himself by bicycle, Alder traces the two men's paths and describes an error that the pair introduced that persists in the metric system today. Drawing on correspondence and extensive research, Alder's examination of the quest to determine the meter and how this error affected Delambre and Méchain makes for a marvelous tale. ***Free Pr, 2002, 422 p., hardcover, $27.00.***

THE OCTOPUS AND THE ORANGUTAN: More True Tales of Animal Intrigue, Intelligence, and Ingenuity

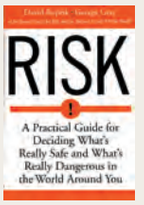
EUGENE LINDEN

Though people think squirrels are ingenious and that birds and even fish can be clever, most of us, if we consider animal intelligence at all, tend to focus on primates. Linden formerly shared this bias, but no more. In a follow-up to *The Parrot's Lament*, he provides a wealth of anecdotal evidence that many animals have remarkable mental capabilities. He offers stories of orangutans, elephants, and octopuses that can pick locks and take apart cages and a dolphin that chastises its trainer. Many other scientists argue that these vignettes aren't scientific evidence of intelligence. Linden argues that that attitude is self-limiting. Animals "do their best thinking when it serves their purposes," not necessarily when scientists are studying them in a laboratory, Linden asserts. He says we should open our minds to the brainpower of animals, which is exhibited in the ways they deceive each other and us, trade and barter among themselves, and make tools. ***Dutton, 2002, 242 p., hardcover, $23.95.***

RISK: A Practical Guide for Deciding What's Really Safe and What's Really Dangerous in the World Around You

DAVID ROPEIK AND GEORGE GRAY

Keenly aware of the anxiety many people have about their health and security nowadays, two risk analysts from Harvard University put 50 such concerns into perspective. In a scientific approach, Ropeik and Gray synthesize peer-reviewed data on a gamut of hazards, from cell-phone radiation to food poisoning, and tell what can be done to reduce associated risks. They point out that people are generally overly concerned about what are really low-risk threats. For instance, the authors detail how the X rays in a mammogram or exposure to most pesticides is less risky than sunbathing without sunscreen or simply walking around your house. Regarding the latter, they point out that 16,200 people in the United States died in 2000 from accidental falls. ***HM, 2002, 485 p., b&w illus., paperback, $16.00.***



LETTERS

For real

There are unfortunate multiple misuses of the word "artificial" in describing lab-grown diamonds in "Better-Built Diamonds: Fast growth, purity may multiply uses" (*SN: 9/14/02, p. 165*). In gemological use, *artificial* means imitation or not real. In fact, the lab-grown diamonds described in your article are real, synthetic diamonds with all the properties and chemistry of natural diamonds.

FRED WARD, BETHESDA, MD.

Healthy to the end

"Could the Anasazi have stayed?" (*SN: 9/14/02, p. 174*) comments that factors other than drought, such as disease, may have been at work in accounting for the disappearance of some Anasazi groups. If it is found that disease was a major factor, it would be unprecedented. As far as has been determined, the Anasazi didn't experience exotic, culture-busting pathogens until Columbus made landfall.

WILLIAM PRESTON, CALIFORNIA POLYTECHNIC STATE UNIVERSITY, SAN LUIS OBISPO, CALIF.

Tweet treat

Regarding "Save Our Sounds" (*SN: 9/14/02, p. 168*), around the early 1950s, during the intermissions of the Sunday radio broadcasts of the New York Philharmonic Orchestra, the announcer introduced recordings of extremely complicated birdcalls. The sounds were obviously somewhat comparable to various musical instruments and marvelously complex. Perhaps one of your bird librarians might be interested in finding the source of the early recordings used in those broadcasts. Also, I have been teaching my local mockingbirds the "birdie, birdie" call of the eastern cardinal, followed by the two-note bridge of "Somewhere over the Rainbow." They do quite well in repeating them back to me and in teaching them to their offspring.

DOLAN EARGLE, SAN FRANCISCO, CALIF.

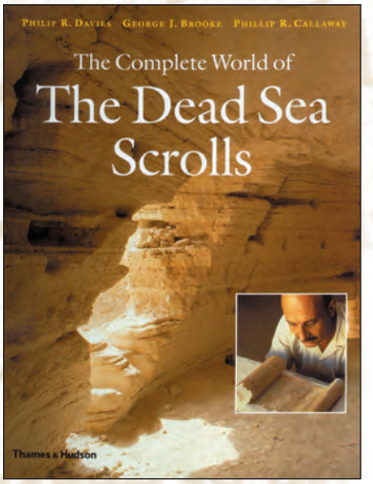
Unknown cause

In "Smoking Gun? Mouse tests link nicotine to crib death" (*SN: 9/14/02, p. 163*), the description of sudden infant death syndrome (SIDS) as accidental suffocation is as unfortunate as it is incorrect. SIDS is the sudden, unexpected death of an apparently healthy infant that remains unexplained. Hopefully, the interesting research highlighted in the article may be a significant step in understanding these tragic deaths.

HEIDI LLOYD-PRICE, CALGARY SIDS SOCIETY, CALGARY, ALBERTA

discovery... meaning... significance

The Dead Sea Scrolls



Ever since a Bedouin shepherd found the first scrolls in the Judean desert in 1947, the Dead Sea Scrolls have been the subject of passionate speculation and controversy. The possibility that they might challenge many assumptions about ancient Judaism and the origins of Christianity, coupled with the extremely limited access to the scrolls imposed for many years, only fueled debate on their meaning.

With all the scrolls—more than 800 documents from 11 caves—now finally available in translation, conclusions can at last be drawn as to their authorship and origins, their implications for Christianity and Judaism, and their link with the ancient site of Qumran. This timely book, written by three noted scholars in the field, draws together all the evidence and presents the first fully illustrated survey of every major manuscript, from the Copper Scroll, the Community Rule and the Temple Scroll to less well-known scripts such as the Angelic Liturgy and Reworked Pentateuch.

- "The Scrolls Reveal" takes the readers through the discovery of the scrolls, culminating in the great finds of 1947–53.
- "The Ancient World of the Scrolls" presents the dramatic historical backdrop against which the scrolls were written and describes Jewish religious life, the pivotal role of the Jerusalem Temple, and competing Jewish sects.
- "Inside the Scrolls" provides a unique illustrated catalog of the contents of all 11 caves, including detailed analysis of every major scroll, and considers the methods of interpretation employed, including carbon-14 dating, paleography, and computer reconstruction.
- "The Qumran Settlement" discusses recent archaeological work at the ancient site, where it is believed that the authors of the scrolls lived, revealing differing theories about its inhabitants and exploring possible links between the caves and Qumran.
- "The Meaning of the Scrolls" examines the heated debates over various interpretations of the scrolls and draws conclusions on the controversy surrounding their authorship.
- With numerous reconstructions, scroll photographs, and a wealth of other illustrations, this book offers the most comprehensive and accessible account yet published of the Dead Sea Scrolls.

—from Thames Hudson

Thames Hudson, 2002, 216 p., 7 ¾" x 10 ⅛", hardcover, $34.95.

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