

# SCIENCE NEWS

THE WEEKLY NEWSMAGAZINE OF SCIENCE

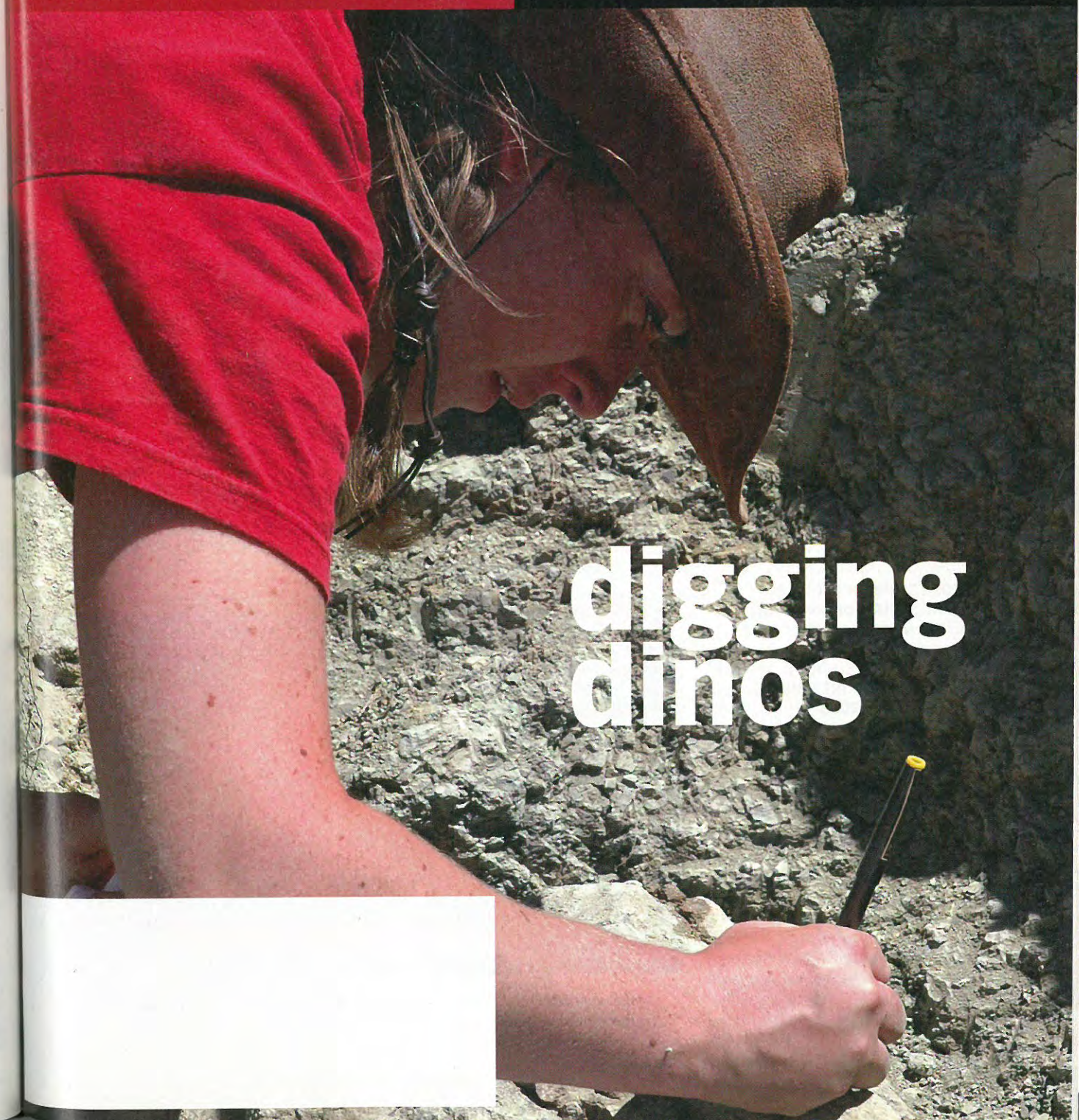
map time

matter out of the dark

genetic legacy: prostate cancer

how taste goes sour

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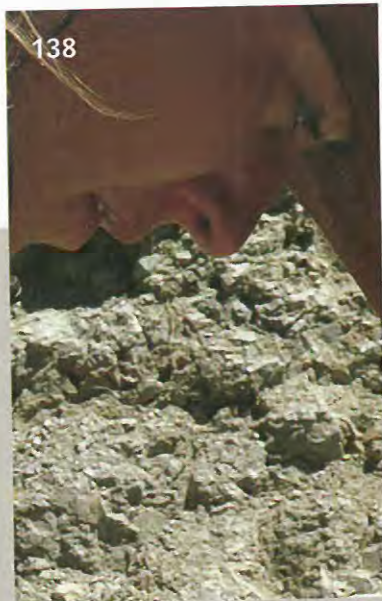
## digging dinos

# SCIENCE NEWS

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**Cover** Fossils make a grueling journey from stony tomb to museum display. This summer, *Science News* writer Sid Perkins participated in a dinosaur dig in Montana. Here, Susannah Maidment, a paleontologist at the University of Cambridge in England, labels limb bones of a stegosaur that the group unearthed. (S. Perkins) **Page 138**

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# SCIENCE NEWS

## This Week

## Enlightened

### Dark matter spotted after cosmic crash

An intergalactic collision is providing astronomers with a giant payoff: the first direct evidence of the invisible material that theorists say holds galaxies together and accounts for most of the universe's mass.

For some 70 years, cosmologists have agreed that theories of gravity account for observations in Earth's solar system but fail on a larger scale. For example, if those theories held throughout the universe, objects on the outskirts of the Milky Way would rotate more slowly than those toward the center. But they don't.

Scientists have offered two competing explanations of this discrepancy. The first is that an invisible substance called dark matter accounts for 90 percent of the universe's mass and gravity. Although scientists don't know what dark matter consists of, they propose that it keeps each galaxy intact (*SN*: 8/13/05, p. 104).

The second explanation says that dark matter doesn't exist and that traditional models of gravity simply need modification.

To search for dark matter, Douglas Clowe of the University of Arizona in Tucson and his colleagues used several telescopes and observatories to image an unusually energetic collision between two galaxies that occurred 100 million years ago.

Normally, as galaxies travel through the universe, gravity keeps dark and ordinary matter close together, so the invisible substance can't be distinguished. During a galactic merger, however, hot gases from one galaxy bump into hot gases in the other and both galaxies are slowed by a force similar to wind resistance. But dark matter from one galaxy, in theory, passes right through another galaxy's dark matter (*SN*: 4/23/05, p. 264).

"Dark matter particles don't experience the same type of drag that slows down gas clouds," says Clowe.

His team used a technique called gravitational lensing to locate the main mass in the aftermath of the collision (*SN*: 5/20/00, p. 332). If dark matter didn't exist, all the mass would have been lumped together with the gases. Instead, the researchers found most of the mass in clumps that appeared to have whizzed past the hot gases.

Only a theory of gravity that includes dark matter can explain the separation, Clowe's team argues in an upcoming *Astrophysical Journal Letters*.

"This proves in a simple and direct way that dark matter exists," says coauthor Maxim Markevitch of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. "It puts to rest the remaining doubt that cosmologists have had until now."

The matter separation caused by the collision is "mind-boggling," says cosmologist Michael Turner of the University of Chicago. However, he adds that the researchers can't rule out alternative theo-

ries, in part because the models from them are so inconsistent.

Alternative models will have a hard time challenging the new finding, maintains astrophysicist Katherine Freese of the University of Michigan in Ann Arbor. "It's going to make it tough for anybody to compete," she says.

Down the line, the observation might give researchers important insights into intergalactic mergers, says Turner. "It's kind of like a cosmic centrifuge," he says. —E. JAFFE

## Risky Legacy

### African DNA linked to prostate cancer

The high rate of prostate cancer among African American men may result in large part from a newly identified stretch of DNA passed down from their African ancestors.

A black man's odds of developing prostate cancer by age 55 are more than twice those of a white man. The racial discrepancy is less pronounced when the disease appears later. Researchers have suspected for years that genetic factors account for part of the racial difference in risk.

Most African Americans have both African and European forebears, so their chromosomes are mosaics of genes from the two continents. Previously identified genetic markers indicate that in U.S. blacks, an average of about 80 percent of the DNA is African in origin.

Geneticists have long hypothesized that they could identify disease-causing chunks of DNA by sifting through the genomes of ethnically mixed populations and noting where people with a disease tend to have genes from the same ancestral source, says David Reich of Harvard Medical School in Boston. Recent technical advances have made this approach feasible.

Reich and his colleagues analyzed the genomes of nearly 1,600 African Americans who had developed prostate cancer. In those men, a portion of chromosome 8 containing nine known genes was more frequently of African origin than were other portions of the DNA.

When the team tested nearly 900 cancer-free African American men, African ancestry of DNA turned up no more frequently in the implicated portion of chromosome 8 than elsewhere in their genomes.

Those findings suggest that having African rather than European DNA at the chromosome-8 location places a man at high risk of prostate cancer, the researchers report in an upcoming *Proceedings of the National Academy of Sciences*.

The team found the most dramatic link between men's developing cancer at a young age and having the African chunk of DNA. "The risk factor we've identified is clearly



**CRASH COURSE** This composite image from several observatories and telescopes shows where two clusters of galaxies collided 100 million years ago. The ordinary matter, shown in pink, from the two galaxies collided, whereas the dark matter from each galaxy, shown in purple, passed straight through.

more important for younger men than for older men," Reich says.

That finding is the study's most important new observation, says geneticist B. Jill Williams of Louisiana State University Health Sciences Center in Shreveport.

Its other findings merely confirm data reported in the June *Nature Genetics*, contends Kári Stefánsson of deCODE Genetics in Reykjavik, Iceland. In that study, he and his colleagues linked an elevated risk of prostate cancer to a gene variant in the chromosome-8 segment examined by Reich's team. That variant is carried by nearly one-third of African Americans but appears at lower frequencies in Europeans and white Americans, Stefánsson says.

However, the variant identified by Stefánsson's group explains only a fraction of the newly reported association between prostate cancer and African ancestry in the critical stretch of chromosome 8. "There must be important and unidentified risk factors for prostate cancer in this section of genetic material," Reich concludes.

"It's also possible and, I think, more likely that there are other variants of the same gene," counters Stefánsson. —B. HARDER

## Fields Medals

### Mathematicians win awards for geometry, physics, and probability

Grigori Perelman electrified the mathematical world 3 years ago with his claim to have solved one of the most famous problems in mathematics (*SN*: 6/14/03, p. 378). The Russian mathematician has now been awarded a Fields Medal, the highest honor in mathematics, given every 4 years to up to four recipients age 40 or under.

Fields Medals, presented this week at the International Congress of Mathematicians in Madrid, also went to Wendelin Werner of the University of Paris-Sud in Orsay, Andrei Okounkov of Princeton University, and Terence Tao of the University of California, Los Angeles.

Perelman's work provides proofs of two major questions in topology, the mathematical theory of shapes. The century-old Poincaré conjecture states that if every loop embedded in a compact three-dimensional shape can be pulled down to a single point, then the shape is a three-dimensional sphere, albeit possibly a deformed one. The

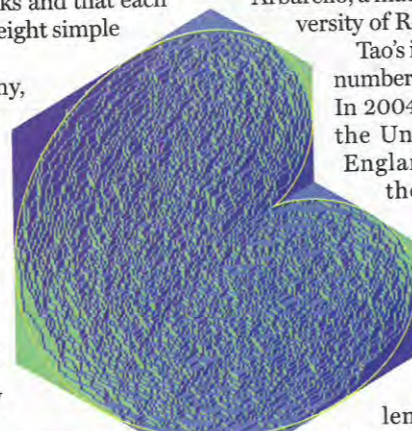
more recent but even more far-reaching Thurston geometrization conjecture states that every three-dimensional shape can be broken down into chunks and that each chunk possesses one of eight simple geometric structures.

In 3 years of scrutiny, mathematicians have uncovered no major flaws in Perelman's proofs of the two conjectures. Researchers have now written more than 1,000 pages elucidating his ideas. If his Poincaré proof goes unrefuted for another 2 years, Perelman may be eligible for a \$1 million prize offered by the Clay Mathematics Institute in Cambridge, Mass., for a proof of the conjecture. However, Perelman has dropped out of the mathematical scene, and when tracked down in St. Petersburg, Russia, he refused to accept the award.

Werner, another of this year's Fields Medal winners, has made seminal advances in areas including percolation theory, an abstract model of how a fluid or gas filters through a semiporous material such as a sponge. At a critical degree of a material's porosity, the fluid inside forms a pattern of clusters that looks roughly the same at any scale larger than very small ones. Werner and his collaborators calculated such a pattern's fractal dimension, a measurement of the jaggedness of the clusters' boundary. The researchers also related these patterns to the trajectory of a Brownian path—the random route taken by, say, a pollen grain in a glass of water—to prove a decades-old conjecture.

Werner's work is "a watershed in the interaction between mathematics and physics," says Charles Newman, director of New York University's Courant Institute of Mathematical Sciences.

The other two winners' work also forged new links between physics and mathematics. For instance, Okounkov has used ideas from geometry and probability to characterize random shapes, such as the ones that form as tiny blocks melt off the corners of a cubical crystal. Okounkov linked the distribution of blocks of different sizes to the ways in which a whole number can be partitioned into a sum of smaller numbers. Using this connection, he and Richard Kenyon of the University of British Columbia in Vancouver showed that the two-dimensional shadow of such a crystal always has a distinctive shape and lies inside a simple curve. Okounkov possesses



**PRIZE NUMBERS** In work recognized with a Fields Medal, a heart-shaped curve encircles the melting region in a crystal representation of a random surface.

"an unusual intuition that makes him able to find unexpected bridges between seemingly distant theories," says Enrico Arbarello, a mathematician at the University of Rome.

Tao's interests include prime numbers and quantum physics. In 2004, he and Ben Green of the University of Bristol in England proved that even

though primes are few and far between, their sequence contains arithmetic progressions—sequences of numbers that differ by a fixed amount—of every possible length (*SN*: 4/24/04, p. 260). Tao has also made contributions to the study of wave maps,

which are related to Einstein's equations of general relativity, and nonlinear Schrödinger equations, which describe the behavior of light in a fiberoptic cable and other quantum phenomena.

"Some of his work gives one a feeling of awe that a human mind can master such complexity," says Princeton mathematician Charles Fefferman. "And some makes one wonder how so many researchers could have missed something so seemingly obvious." —E. KLARREICH

## Sweet Finding

### Researchers propose candidate sour sensor

Two teams of scientists have identified a protein on the surfaces of select tongue cells that may be the long-sought detector of sour taste.

People and some other animals, including mice, distinguish five recognized tastes: sweet, bitter, sour, salty, and umami, the flavor of monosodium glutamate. Over the past 6 years, researchers including Charles S. Zuker of the University of California, San Diego have ferreted out proteins on tongue-cell surfaces responsible for receiving sweet, bitter, and umami sensations.

To locate the sour-taste receptor, Zuker's team started with a few assumptions based on previous findings. For example, a sour-detecting protein would weave in and out of the membranes of tongue cells, as the taste receptors already identified do. Previous studies also suggested that each tongue cell produces no more than one type of taste receptor.

Zuker's team scanned the mouse genome, looking first for genes that encode membrane-spanning proteins that resemble the known taste receptors. To narrow

down the thousands of candidates, the researchers focused on genes that make rare proteins in the body, rather than genes responsible for proteins that carry out general functions in all cells.

Zuker and his colleagues searched in tongue tissue for each protein that met those criteria. They eventually located a single protein, called PKD2L1, that's in some taste bud cells but not in those that detect sweet, bitter, and umami flavors.

To test whether PKD2L1 is important for sensing sour, the researchers engineered mice so that any cells bearing the protein died before the animals were born. Zuker's team reports in the Aug. 24 *Nature* that nerves in these rodents' tongues responded normally to other tastes but didn't respond when the researchers gave the animals solutions of sour chemicals such as citric acid or vinegar.

The mice "were completely insensitive, just like we were dabbing their tongues with water," Zuker says. His team's findings "show that sour taste is mediated by cells bearing this unique receptor protein," he adds.

Those results are "really exciting," says Hiroaki Matsunami of Duke University Medical Center in Durham, N.C., whose team also proposes PKD2L1 as a sour-taste receptor. That work appears in the Aug. 15 *Proceedings of the National Academy of Sciences*.

Matsunami speculates that researchers may someday exploit this research to change the taste of foods—for example, by increasing a soda's sourness without upping its tooth-degrading acidity. —C. BROWNLEE

## Underage Spiders

### Males show unexpected interest in young mates

To the surprise of biologists, a male Australian redback spider will mate with a juvenile female before her reproductive tract has an external opening. The male bites through the immature female's outer covering and by doing so, protects his own life.



**DANGEROUS LIAISON** Among adult Australian redback spiders, the male (in upper position) is much smaller than the female.

This discovery adds a new twist to a textbook example of extreme mating practices. Until now, biologists had focused on these *Latrodectus hasselti* males' apparently suicidal sexual behavior with adult females.

While delivering sperm to a mature female, a male typically flips his body and ends up dangling above her fangs, explains Daniela Biaggio of the University of Toronto at Scarborough. Many of these males become lunch, but studies have shown that their sacrifices boost their share of their mates' offspring (*SN*: 11/13/99, p. 312).

The studies had overlooked an alternative male tactic, Biaggio reported Aug. 14 in *Snowbird*, Utah, at the annual meeting of the Animal Behavior Society. She's found that given a chance in the lab, males mate non-suicidally with females that haven't yet molted the final time.

Biaggio says that she discovered this alternative mating strategy while observing a practice that's widespread among spider species: adult males hanging around immature females. As Biaggio was arranging her subjects after an experiment, she found one pair entangled. "I freaked," she says.

Her coauthor Maydianne Andrade, also in Scarborough, says that she was "incredulous" when Biaggio first told her the story. However, they took a new look at female anatomy. About 2 days before a female's final molt, her internal reproductive organs look fully formed.

Biaggio then paired adult males with females at various phases of their final pre-molt periods. The only mating occurred among males paired with females just a few days from molting. Of 18 males in this group, 72 percent bit through the female's cuticle and delivered sperm. They rarely somersaulted toward the female's mouth, says Biaggio.

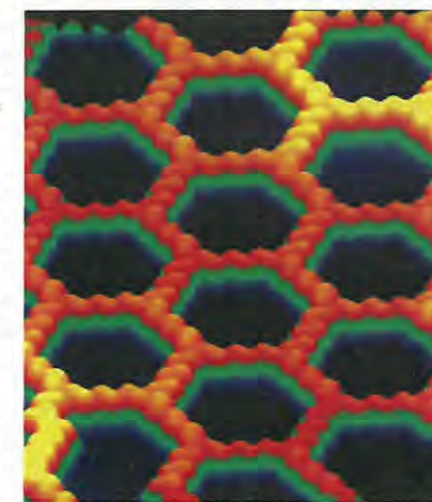
Afterward, the females molted normally and laid fertile egg clutches. Biaggio says that males won't mate again if they've used both of their non-refillable sperm-delivery organs.

Andrade says, "After we had substantiated [Biaggio's] observations, I realized I had likely seen this behavior in the field but wrote it off as misguided males mounting juvenile females."

Arthropod behaviorist Linda Rayor of Cornell University says that she hasn't heard another report of male spiders breaking through the outer covering, or exoskeleton, of juveniles to mate. "This is really weird," she says.

Yet she adds that it fits with the extreme pressures on males among many insects and spiders, including the redbacks, to be a female's first mate. That early suitor of adult females often fathers the largest percentage of her offspring.

Eileen Hebets, who studies arthropods at the University of Nebraska in Lincoln,



## Lacy molecular order

This surprising honeycomb pattern emerged after an organic-chemical vapor settled onto a cold copper surface, which was then heated and cooled. On copper (black), each anthraquinone molecule appears in this scanning tunneling microscope image as a mound that's orange or yellow on top, green in the middle, and blue at the base. Scientists had never seen spontaneous molecular patterns include voids that were so much bigger than the molecules themselves, says Ludwig Bartels of the University of California, Riverside. The pattern results from a balance of attractive and repulsive forces, his team proposes in the Aug. 18 *Science*. Typically, making such open patterns requires elaborately crafted templates. Bartels suggests that by merely tweaking properties of molecules or surfaces, researchers might generate various patterns and pore sizes. —P. WEISS

notes that insects don't always respect the integrity of each other's exoskeletons. Male bedbugs, for example, routinely ignore female reproductive-tract openings and poke their own openings for mating. —S. MILIUS

## Pathogen Preference

### Infected amoebas flourish in cooling towers

Cooling towers on buildings harbor amoebas infected with both known and unknown types of bacteria. New research raises the possibility that such towers are more effective than natural waters at fos-

tering novel bacterial species that cause illnesses in people.

Scientists suspect that many microbial species responsible for human illnesses first preyed upon amoebas, unicellular organisms found in aquatic environments. Though microscopic, amoebas normally are shaped like "a piece of chewing gum that's been chewed," says Sharon G. Berk of Tennessee Technological University in Cookeville. But after they've been infected by bacteria, they become spherical. Finally, they burst and release the bacteria, she says.

Well known among those pathogens are *Legionella pneumophila* bacteria, which cause Legionnaires' disease. Cooling towers—structures that cool water streams for air conditioning, power generation, or other purposes—are a source of *Legionella*-infected amoebas. These towers cool water by exposing it to outside air and then blowing out warm air. That airflow carries fine water droplets, which can release bacteria.

Berk and her colleagues wondered whether infected amoebas would be more prevalent in cooling towers than in natural water environments. They took samples from cooling towers on hospitals and industrial buildings and also from rivers and lakes.

The researchers found infected amoebas in 22 of 40 cooling tower samples but in only 3 of 40 natural samples. A statistical analysis revealed that cooling towers were 16 times as likely to contain infected amoebas as were natural aquatic environments, the researchers report in an upcoming *Environmental Science & Technology*.

The scientists then attempted to grow the amoeba-infecting bacteria on laboratory plates for identification but succeeded for only a small number of the bacteria. Of the strains identified from the cooling tower samples, three were *L. pneumophila*, three more were new strains related to known bacteria, and one was novel, notes Berk.

Berk says that she expects that many more unidentified pathogens were living in the amoebas. The researchers don't know why amoeba-infecting bacteria flourish in the cooling tower environment.

The study "adds some insight relating to both the environmental complexity and the potential for emergence of new disease from cooling towers," says microbiologist Richard Bentham of Flinders University in Adelaide, Australia. "The implication of cooling towers as 'pathogen accelerators' makes them an intriguing research focus."

James M. Barbaree, a microbiologist at Auburn University in Alabama, agrees that conditions in cooling towers appear conducive to the growth of infected amoebas. But considering how many different water environments there are, he adds, "I don't think you would say that it explicitly is going to occur more in all cooling towers than [in] all natural samples." —A. CUNNINGHAM

## Mercury Rising

### Natural wildfires release pollutant

**Fires in high-latitude forests and peaty soils of the Northern Hemisphere may loft hundreds of tons of mercury into the atmosphere each year, much more than scientists had expected, a new analysis suggests.**

Much of the world's industrial emissions of this toxic pollutant originates from the burning of coal contaminated with the element. "When it comes back to the ground, mercury forms strong chemical bonds with organic material, so it often gets locked away in rich forest soils and in peat," says Merritt R. Turetsky, an ecologist at Michigan State University in East Lansing.

Scientists estimate that industrial sources together with natural ones such as volcanoes annually send between 4,400 and 7,500 tons of mercury into the atmosphere. Previous studies suggested that wildfires in upland forests of the Northern Hemisphere release about 23 tons of the pollutant each year. However, soil data and new computer models now indicate that wildfire emissions of mercury could be much higher, Turetsky and her col-

leagues report in the Aug. 28 *Geophysical Research Letters*.

In fires in Alaskan and Canadian forests, much of the material that burns is twigs, moss, and other organic material on the ground and in the soil, says Turetsky. Each square meter of forest soil contains about 3.4 milligrams of mercury. Concentrations are even higher in peaty soils, where the dry surface layers hold about 11.5 mg/m<sup>2</sup> of mercury, the team finds.

Scientists had generally considered peat lands not susceptible to fire, says Turetsky. However, by examining the carbon content of peat, she and her colleagues recently found that those areas burn, on average, once every century or so—a rate that's similar to that in northern forests. The scientists estimate that more than 10,000 square kilometers of forest and peat lands burn worldwide each year, sending more than 340 tons of mercury into the atmosphere.

"This is a sizable pool of mercury," says Richard Bindler, an environmental scientist at Umeå University in Sweden. The amount of the pollutant returned to the atmosphere by fires is much larger than the quantity that leaves the forests and peat lands via runoff, he notes.

The acreage burned each year in North American boreal forests has approximately doubled in the past few decades, says Eric S. Kasischke, a fire ecologist at the University of Maryland at College Park. Moreover, increased droughts anticipated in arctic regions could cause water tables to drop, leaving more mercury-tainted peat vulnerable to fire. "When water levels are low enough, a substantial amount of peat can be consumed [by fire]," thereby boosting mercury emissions, he notes. —S. PERKINS



**TAINTED SMOKE** Plumes lofted from wildfires in Northern Hemisphere peat lands and forests, such as this Alaskan blaze in June 2003, annually release about 340 tons of mercury.

TURETSKY

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# MUTANT MAPS

Borrowing an idea from biology to enrich history

BY PETER WEISS

In London last month, the numerals 1623 stared out from the title page of a rare Shakespeare book. Printed in a quaint typeface, those digits left no mystery about the publication date of that highly prized volume—which fetched \$5.2 million at a Sotheby's auction on July 13. Were publication dates so easy to come by for some other treasures by the Bard and for thousands of other undated books, maps, etchings, and other printed works, many uncertainties in history and other fields might quickly clear up, scholars say.

Hungry for missing publication dates, rare-document specialists scrutinize watermarks, book bindings, and even tiny imperfections in individual letters of old tracts.

"People want to know when ideas were developed. In the history of society in general, dates are important," says S. Blair Hedges of Pennsylvania State University in University Park.

An unexpected inspiration from genetics recently led Hedges—a biologist with a penchant for old books and maps—to develop a new way to sleuth missing dates.

His work indicates that the print quality declines with the steady aging of the blocks and plates used in the printing process, not with how often they are used, as most specialists had suspected. As biologists calculate species ages from the accumulation of genetic mutations, or molecular clocks, Hedges employs a "print clock." His method estimates publication dates with extraordinary precision, he reports, as long as other editions or related documents with known dates are available as guideposts.

There were more than 3 million books printed on hand-operated presses using woodblocks and copper plates from the 1400s to the mid-1800s, and many of those books weren't dated, Hedges notes. "This method could maybe put a date on many of those books," he says.

If verified, "his process would be to bibliography as carbon dating is to archaeology," comments David L. Gants, an old-book scholar at the University of New Brunswick in Fredericton.

Adds R. Carter Hailey, another specialist in old books, at the College of William and Mary in Williamsburg, Va., "Dr. Hedges' approach, if it can be substantiated, is of immense potential value."

**WEAR AND TEAR** Hedges' work began as a hunch about books that's based on biology. About a year and a half ago, he was examining copies of a 16th-century book of Caribbean-island maps printed from woodblocks. Printers from this era would often use the same woodblock or plate in each subsequent edition of a book.

This book—known as *Isolario* by Benedetto Bordone—appeared in four editions: three dated 1528, 1534, and 1547, and one without a date. For 200 years, rare-book specialists have been debating when the undated edition was printed.

As Hedges looked at the various editions, patterns of defects in the maps caught his eye. He noticed gaps here and there in lines on the maps. "In the first edition, there were very few. The later-dated editions had progressively more breaks. That's when I got the hunch," Hedges recalls, "I thought these line breaks are kind of like genetic mutations."

In organisms, the genetic code changes haphazardly, or mutates, at random intervals as a result of chemical reactions or other insults, and the resulting mutations in DNA accumulate over time. Biologists can calculate the average rate of mutation over millions of years of evolutionary transformation. They can then use that average to estimate when one species diverged from others.

As Hedges pored over the *Isolario*, it occurred to him that random defects in wood blocks—like genetic mutations—may also have accumulated over the years at a constant average rate. If so, then bibliographers could exploit that rate to date documents relative to those with known publication dates. "It's the same principle—

counting the number of differences," he notes.

Hedges knew that line breaks in old wood-block prints resulted from cracks in the blocks' raised ridges, which produce the lines. The underlying cause—the drying of the wood—would have taken place steadily over time.

In prints made from copper plates, Hedges observed a different pattern of change. Printmakers created designs on copper plates by etching the metal with acid or engraving it, that is, goug-

ing it with a sharp tool. Hedges noticed that the lines of prints from a specific plate are typically thinner in later editions than in earlier ones, so the overall image in later editions appears faded.

Researchers had long thought that it was the printing press that caused the damage to the copper plate. "I realized that was not correct," Hedges recalls. The pressure of the printing press should make the lines thicker, not thinner.

Instead of the squeezing by the press, Hedges claims, a steady process of corrosion as copper plates sat in storage could account for the observed decline in print quality. When the time came to reuse a plate, the printer would have had to scrub and polish its pitted surface. Because etched and engraved grooves narrow with depth, stripping off the top layers of the plate's surface would have made such grooves narrower and, therefore, the lines of the prints thinner. While scourings would have occurred episodically, the corrosion would have proceeded at a regular pace.

Indeed, the rate at which corrosion penetrates the copper surface is 1 to 2 micrometers per year, Hedges says. This matches the amount of metal stripped off over time by printers, as indicated by line thinnings, he calculates.

Hedges backs up his observations by pointing out that 17th-century instruction manuals for printers indicate that scouring plates between print runs was common practice.

Not everyone is convinced by Hedges' proposal. For example, John A. Buchtel, the curator of rare books for libraries of Johns Hopkins University in Baltimore, says that he's seen prints made from copper plates that visibly changed within the same print run.

**TICK TOCK** Hedges says that his tests so far support the print-clock hypothesis. He found 23 copies of *Isolario*, including all the editions, in rare-book libraries. He then counted the number of line breaks in the 112 map prints contained in each book.

Because the numbers of line breaks per print were small, Hedges totaled all the breaks per book—which ranged from about 100 apiece for the 1528 edition to about 300 apiece for the 1547 edition. When he analyzed the data, he found that a steady accumulation rate of line breaks per year matched up with the publication dates of the three successive dated editions.

He next turned to the undated copy of *Isolario*. That edition had more line breaks than any of the others. Hedges calculated that it was published in February 1565, plus or minus 16 months.

Conveniently, another characteristic of the undated *Isolario* edition—a small, intricate pattern on its title page, called the printer's mark—gave Hedges an independent way to estimate that date. He took advantage of computerized-image-analysis methods that are used by medical scientists. He applied them to high-resolution digital images of printer's marks from *Isolario* and other dated books from the same Renaissance printer. His second estimate for the undated *Isolario* was April 1565, plus or minus a year.

The dates estimated by line breaks and by the printer's mark are similar, and both fall between 1537 and 1570, the period in which previous evaluations by rare-book specialists had placed the undated edition, Hedges notes.

Gants says, "For the first time, we can pinpoint to [a few] months when a wood block has been used. That's much, much more precise than we've been able to do before."

Buchtel adds that on the basis of historical information about

*Isolario*'s printer, catalogers at Johns Hopkins had estimated that the undated edition was published between 1561 and 1567. "To have [Hedges'] technique plunk it right down in the middle of that date range ... does make his findings seem plausible," he says.

As one way to confirm his approach to dating copper-plate prints, Hedges used the computerized-image analyses to determine the paleness of the prints from editions of two old map books, *L'isole più famose del mondo* by Thomas Porcacchi and *Geographiae* by Giovanni Magini, all of which contained publication dates.

For both books, the fading was proportional to the amount of time between publication dates of six editions of Porcacchi's book, from 1572 to 1620, and of three of Magini's, from 1596 to 1621. "That demonstrates that the wear happened with time and not with printing events," Hedges says.

The Magini editions provided a particularly stringent test of the print-clock hypothesis, Hedges notes. Only 2 years separated the first two editions, whereas 23 years elapsed between the second and third.

In another type of test, Hedges used a computer to compare line widths in high-resolution digital images of Porcacchi's maps in two editions that were 28 years apart. Measurements at 1,200 specific locations per print in two pairs of early and late prints indicated that line thinning was, in fact, responsible for the paling of the prints.

Hedges describes the new methods in a report, already available online (<http://evo.bio.psu.edu/hedgeslab/Publications/PDF-files/176.pdf>), that's slated to appear in an upcoming *Proceedings of the Royal Society of London A*.

Hailey says, "The approach does seem to me plausible, though substantial additional data will be required to validate it."

**TERRA INCOGNITA** The new method is about to foray into the world. Gants say that he's planning to test its validity. Next year, he'll investigate whether the method can replicate the known dates of 11 editions of a theological tome printed on copper plates between 1611 and 1723. The analysis will focus on an orna-

mental border on the book's title page.

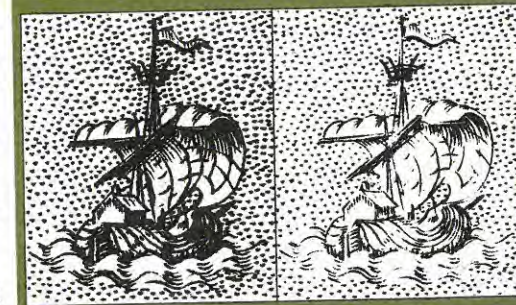
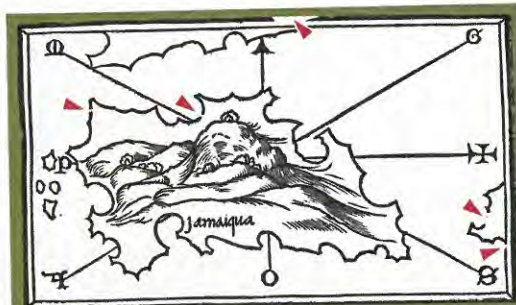
The "next challenge then is to do the same thing on different data sets," Gants says.

Hedges welcomes independent tests of the approach and is interested in seeing how widely it can be applied. He intends eventually to try it on some undated Rembrandt prints. The artist used etching techniques similar to those employed for book plates. To help others use his approach, Hedges offers a Website full of technical pointers (<http://evo.bio.psu.edu/printclock/index.htm>).

Hedges' next project will focus on Shakespearean texts. These plays appeared in many printed versions, including the 1623 "First Folio," which sold for a huge sum last month at auction.

Hedges says that he's made arrangements with the Folger Shakespeare Library in Washington, D.C., to apply his computer analysis of printer's marks this fall to the only two early books of Shakespeare plays—one of "Romeo and Juliet" and the other of "Hamlet"—that lack publication dates. Those books figure prominently in heated scholarly debates about the development of Shakespeare's work. Fortunately, the volumes share a printer's mark with other dated, non-Shakespeare volumes.

"People want to know how [the plays] evolved and why things were added and when it happened," Hedges notes. His method may soon shed some welcome new light onto the world stage. ■



**AGE LINES** — Breaks such as those marked by arrowheads (red) in a 16th-century map of Jamaica (top) mar woodblock prints more often in later editions than in earlier ones. However, prints made from copper plates (bottom) fade from early to late editions, as seen in these ship details from the 1576 edition (left) and 1604 edition (right) of the same Italian map book. A new method for determining the publication dates of undated editions tracks such changes.



**TIME'S IMPRINT** — A carved woodblock (top) dries out and cracks between print runs, resulting in broken lines in subsequent prints. Scouring away corrosion on a copper plate (bottom) wears down the metal and may narrow engraved grooves, causing thinner lines in later prints.

HEDGES AND B. BORDONE, HEDGES AND PORCACCHI

# BONE HUNT

A reporter's week in the wilds of Montana

BY SID PERKINS

“I think I've found something!” The call rang out from across the quarry. Suddenly, a dozen or so would-be paleontologists—myself included—shifted their mental focus from the small zones of rock immediately in front of them to a new center of attention. Having spent the last few hours using hand tools to grub our way through crumbly rock with little tangible result, we found the idea that someone had actually found something to be exciting indeed.

Nate Murphy, the paleontologist in charge of the dig, strolled over to take a look. “That's something, all right,” he said. A little more excavation revealed the 3-centimeter-long tip of a theropod dinosaur's tooth. Considering the age of the rocks that entombed it, Murphy estimated that the meat eater had shed the fragment around 150 million years ago.

This episode, the first thrill on my recent foray into paleontology fieldwork, was by no means the last. Sure, most of those thrills were vicarious. Other folks found many more fossils—and more impressive ones—than I did. Nevertheless, I gained an understanding invaluable to my writing about paleontology—how dinosaur bones start their journey from rock formations into museums.

My invitation from Murphy, research director of the Judith River Dinosaur Institute in Malta, Mont., came late last year. “Have you ever been on a dinosaur dig?” he suddenly asked during a chat at October's annual meeting of the Society of Vertebrate Paleontology. “You need to understand what goes on in the field.”

As I'd already suspected, extracting fossils from their stony tombs is hard, gritty work. The first step often is literally stumbling across bones that have eroded from a hillside. Then, there's some detective work tracking those fragments uphill to their source.

There's the backbreaking work of moving tons of rock to expose layers that hold the ancient bones, followed by the painstaking excavation of sometimes fragile remains that haven't seen the light of day for millions of years.

Most of the time, it's achingly monotonous. But oh, those moments of excitement!

**SUNDAY, JULY 2:** Members of the dig team gather at noon at a hotel in Billings, Mont. Many stayed elsewhere the night before—some at hotels, others at campsites, a few at their nearby homes.

Our 11-vehicle caravan reaches the dig site, about 160 kilometers north of Billings, in a little more than 2 hours. The highways and gravel roads that we follow pass through a variety of landscapes, including ranchland dotted with small oil wells and sparse forests.

We pull into our campsite and pile out of the cars into rolling pastureland. All eyes are immediately drawn to a grim, gray scar on the other side of a small valley, a quarry where Murphy and other paleontologists have, on and off during the past couple of years, spent time unearthing the remains of two large dinosaurs. We are tempted to rush over there, but there is a campsite to set up.

Dave Hein, owner of the ranch, has mowed an area where we can pitch the cook tent and park the supply trailers. Portable toilets are towed to the far side of the campsite, and the camp showers are assembled next to the water truck—compared with digs in more-remote locations, this expedition will be posh, I am told. I will be privileged enough to sleep in the back of a truck.

While the other campers set up their tents, I chat with Hein to

**SETTING UP CAMP** — Teacher Colleen Dundon and others pitch their tents near a dinosaur-dig site on central Montana's 5E Ranch.

**HACKING AWAY** — Behavioral scientist Stephen G. Smith (left) and plaster-mold maker Karl Kockler get into the swing of things while unearthing a stegosaur.

**AGAINST THE WALL** — Paleontologist Adam Stuart Smith and others toil at the quarry, looking for more fossilized remains of Ralph the sauropod.

**HAVING A BLAST** — *Science News'* Sid Perkins uses an air hammer to fracture rock, and retired geologist Greg Sorlie waits to remove the debris.

**WHAT'S THIS?** — Geologist Cris E. Merta inspects chips of fossilized bone that have eroded from a hillside.



Hacking away



Setting up camp

find out more about the site. Some of his wife's ancestors—five brothers from England, from whom Hein's 5E Ranch gets its name—settled here about a century ago. In 1985, Hein first found chips of fossilized bone lying on a hillside.

Then in 2003, he and his son used some earthmoving equipment at the site and came across a few large bones. Realizing the possible importance of the find, they turned to local experts. After a series of phone calls, Hein spoke to Murphy, who has since excavated bones at the site each summer.

Around the campfire after dinner, at Murphy's behest, we take turns introducing ourselves. Our group of 33 includes teenagers, retirees, museum volunteers, geologists, paleontologists, and even a theology professor. Only about half of us have been on digs before, and we are all itching to get our hands dirty.

We spend the rest of the evening in song, 2 hours of guitar- and coyote-accompanied ballads, folk tunes, and sing-along classics such as “Dead Skunk in the Middle of the Road.”

Long after we stumble off to our sleeping bags, the coyotes are still singing.

**MONDAY, JULY 3:** We gather at the site to learn some basic digging skills. The standard-issue tools are awls—think ice picks on steroids—and stiff paintbrushes. We aren't to use the awls like ice picks, however—a motion that Murphy refers to as “Hitchcocking.”

Instead, we are to gently pry apart layers of rock, brushing away the debris and inspecting our work zone regularly so that we won't damage any fossil before we realize it's there. Done right, it's slow going. Poke, pry, sweep, repeat. Fill up a gallon-size scoop with debris, and then dump it in a bucket. Six or eight scoops fill a bucket, and six or eight buckets fill a wheelbarrow. Roll the wheelbarrow downhill, empty it, return to your little section of strata. Fill, roll, empty, repeat. A ton of rock makes a pile much smaller than you'd think.

Late in the morning, the theropod tooth comes to light. No other bones of a meat eater have been found at this site, says Murphy.

In 2004, Murphy and his colleagues finished unearthing the bones that Hein had found, including four neck vertebrae, a portion of a femur, and almost a dozen ribs. They identified the dinosaur as a long-necked herbivore called a sauropod, and the team nicknamed it Ralph, after an earlier member of Hein's family whose homestead had been just a few hundred meters from where the Heins had found the dinosaur.

During the 2005 field season, the paleontologists unearthed seven more neck vertebrae and eventually uncovered Ralph's skull, upside down and half a meter away from the rest of him. Ralph's head had probably rotted off, rolled into that position, and then been buried by an ancient stream. Sauropod skulls are exceedingly rare, says Murphy.

The tooth tip that our team found may have broken off as a theropod fed on Ralph's carcass. The femur fragment found 2 years ago showed signs of having been gnawed on, Murphy notes.

After our lunch, further excavations near the tooth reveal a 20-cm-long fragment of another of Ralph's ribs. A few other, heavily eroded pieces of dinosaur bone turn up, but Murphy says that they probably aren't Ralph's because his fossil bones are usually in good condition.

We also come across plant fossils that may provide clues about the environment in which Ralph died. Cris E. Merta, a geologist from Sheboygan, Wis., notes that at first glance, the plants appear to have been similar to modern-day reeds, so the area may once have been a wetland.

The rocks that hold Ralph probably were deposited as sediment sometime between 150 million and 147 million years ago, says Melissa V. Connely, a geologist from Casper College in Wyoming.

**TUESDAY, JULY 4:**

After breakfast, Murphy takes a few of us over to a neighboring ranch. Last year's dig team found a few bones there beneath a light coating of sand, dirt, and bone chips. About 50 m away, the group discovered the end of a 2-m-long femur sticking out from the ground. Our job today is to remove the plaster jacket that has protected that bone during the winter—from harsh weather as well as from the sharp hooves of grazing cows. We'll then dig farther around the bone so that the fossil can be removed later in the week.

Because the rock is much harder here than it is at the Ralph quarry, we must learn the basics of using small air hammers driven by compressed air. We take turns shattering rock.

As we work several centimeters away from the femur, we're constantly on the lookout for previously undiscovered bones from the same dinosaur. We also have to be careful not to damage the crumbly end of the bone that had been exposed

to the elements before its discovery.

The rock at this site breaks into pieces that are thumbnail-size or larger, so it's a challenge to brush them out of the way as we work. Nevertheless, all goes well until one of the team members doesn't lift his heel quite high enough as he steps backward across the femur. Whoops! Because much of the outer surface of the bone had been bonded together with liquid adhesives, a piece of that veneer the size of a legal pad sloughs off, taking a couple of handfuls of bone chips with it.

We stand frozen, mouths agape, and when we turn off the air hammer, the silence is deafening. Then, a series of quietly muttered curses. After taking a minute or so to



Against the wall



Having a blast



What's this?

## 'Round the Campfire



recover a bit of composure, one of the team members sheepishly retrieves Murphy from the bone site nearby. We explain what happened, plead contrition, and brace ourselves for the worst. Obviously disappointed, Murphy stands mute for a few seconds and then says, "That's OK. If anyone ever tells you they've never broken a [dinosaur] bone, then they haven't really been digging."

Although this is the first truly sunny day of the week, we work under a cloud for the rest of the day.

Except for lunch: As a special treat, Hein has invited the dig team to join his extended family for a Fourth of July barbecue, replete with especially refreshing lemonade and watermelon. Someone breaks out a family photo album and shows us pictures of Ralph, the namesake of the sauropod we're excavating.

All too soon, though, we're back at the neighboring ranch, where we break up more rock. We come upon a few more fossils, which fortunately remain intact.



Getting plastered

After dinner, around the campfire, we learn that discoveries by other team members at the Ralph quarry have slowed to a standstill. However, a few participants roaming the hills about 150 m away have found

some fragments of bone, tracked

them back to their hillside source, and dug out what appear to be a few tail vertebrae and fragments of a spike from a stegosaur.

**WEDNESDAY, JULY 5:** Today, the center of attention shifts from Ralph to the new stegosaur. Further excavation yields more tail vertebrae as well as some limb and foot bones. This site, which stretches along the hillside no more than 6 m or so, is a flurry of pick-and-shovel activity. The small shelf that we've dug into the hillside can barely accommodate all the dig-team members who want to get in on the action.

I take pictures and do my best to stay out of the way. On the third day of the dig, the novelty of excavation has worn off and muscle aches have set in.

That evening, we're rewarded by exciting news. Parts of the stegosaur's tail vertebrae that we excavated weren't fused as they would be in an adult, so the creature may have been a juvenile, says Susannah Maidment, a paleontologist from the University of Cambridge in England.

Other features of the bones suggest that they represent *Hesperosaurus*—an exciting possibility, she notes, because only four other fossils of this stegosaur species have been discovered, all of which are in private collections. The one *Hesperosaurus* that has been described in a journal paper didn't include limb bones, such as the one we've found.

**THURSDAY, JULY 6:** Today at the cozy stegosaur quarry, my fellow diggers and I expose many new bones, including the end of a large one, possibly a femur, that seems to extend quite a distance into the hill.

At the dig site on the neighboring ranch, other team members uncover a tangle of bones that will have to be left for another expedition to excavate. Despite the daylong efforts of the two team members who remain faithful to the Ralph site, no bones are forthcoming.

"You know what you did today?" Murphy asks them at dinnertime. "You just closed that quarry. You put Ralph to rest."

retrieves Murphy from the bone site nearby.

**FRIDAY, JULY 7:** This morning is a frenzy of activity. We have only half a day in the field, during which we must extract some fossils, jacket others, break camp, and head back to civilization.

While some team members sketch the layout of the bones, the less artistic of us—myself included—work with compasses and measuring tapes. A team leader at each site assigns a code number to each bone or assembly, and someone records location data. Small, free-floating bones are wrapped in aluminum foil and labeled. Larger bones are tightly swathed in aluminum foil, then several layers of wet paper towels, then an outer coating of plaster-soaked burlap. Wrestling a fragile, several-hundred-pound lump of stone, bone, and plaster down a steep hill and into the back of a truck is challenging, to say the least.

Mid-afternoon, we head south to Billings. There, for the first time in a week, we can take a shower that is hot and lasts longer than 6 minutes. Then, we get together for dinner at a restaurant. At our final meal as a group, we each speak a few words about the experiences that we've had.

Murphy closes out the speeches by telling us how well our diverse group has listened, learned, and come together as a team.

He plans to immortalize Ralph this fall in a journal paper, giving him a scientific name that will distinguish him in academic circles as a new species. That article will represent a lot of hard work, Murphy notes, adding that we should all proudly consider ourselves a part of the dinosaur-discovery team. ■



Details, details

**'ROUND THE CAMPFIRE** — Videographer Nick Mariana (left) and paleontologist Nate Murphy provide fireside entertainment with their musical stylings.

**GETTING PLASTERED** — Amateur paleontologist Kathie Burke (left) and graphic artist Mary Govaars apply a final coat of plaster to a burlap jacket that will protect fossils from being damaged when they're transported from the quarry.

**DETAILS, DETAILS** — Paleontologist Adam Stuart Smith sketches the limb bones of a newly unearthed stegosaur, a drawing that will enable researchers to reassemble the fossil when it arrives at a laboratory or museum.

# OF NOTE

## ASTRONOMY

### Cosmic bigness

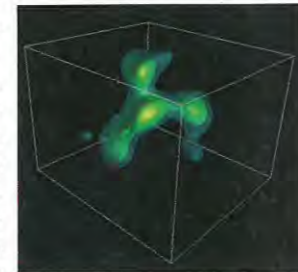
Astronomers have found the largest structures ever discovered in the universe—filaments of galaxies 200 million light-years in length that date from just 2 billion years after the Big Bang.

The filaments contain 30 giant pockets of gas, each of which may be as much as 10 times the mass of the Milky Way. Such large structures were rare in the early universe and are probably the precursors of the type of galaxy clusters seen today, says Ryosuke Yamauchi of Tohoku University in Sendai, Japan. Yamauchi is part of a team that used the

Subaru and Keck II telescopes atop Hawaii's Mauna Kea to study a patch of sky known to contain a high density of galaxies.

Subaru images, combined with velocity measurements from Keck, revealed much fainter objects than had previously been discovered in the region. The pockets of gas, first discovered 6 years ago, are known as Lyman-alpha blobs. The Subaru observatory announced the findings on July 26.

Theory suggests that the seeds of these large structures formed during the birth of the universe, comments John Peacock of the Royal Observatory of Edinburgh in Scotland. —R.C.



**SUPERSTRUCTURE** At least three long filaments of galaxies overlap in this illustration.

## EPIDEMIOLOGY

### Sauna use among dads linked to tumors in children

Would-be fathers who expose themselves to excessive heat in the weeks before they conceive children may place their future offspring at unnecessary risk of brain cancer, new research suggests. The study provides inconclusive data on whether maternal exposure to heat during early pregnancy similarly affects cancer risk.

Past studies have shown that in female animals, exposure to elevated temperature during pregnancy can cause fetuses to die or develop abnormally. Also, human sperm,

which take about 10 weeks to develop, are acutely sensitive to temperature.

Researchers at Children's Hospital of Philadelphia and St. Jude Children's Research Hospital in Memphis, Tenn., studied 318 children who by the age of 6 years had developed either of two related forms of brain cancer. For comparison, the team studied 318 children of similar age and background who were free of cancer.

The investigators interviewed the children's parents to determine whether they had used saunas or electric blankets or had

other exposures to heat, such as bathing in hot tubs, during the months leading up to conception or during the first trimester of pregnancy.

Fathers of children with the two types of brain cancer were 3.4 times as likely as other dads to have used a sauna and 2.1 times as likely to have had exposure to at least one heat source during the 3 months prior to conception. Greta R. Bunin and her collaborators report those findings in the Aug. 1

*American Journal of Epidemiology*.

Exposure to heat sources, including saunas, was not significantly elevated among the mothers of children with the brain cancers, but the study couldn't rule out the possibility of a harmful influence from heat during early pregnancy. —B.H.

## BIOCHEMISTRY

### Protection from poisons

An Alzheimer's disease drug could protect against the deadly effects of two nerve agents, researchers report.

Exposure to organophosphorus compounds, including the nerve agents sarin and soman, can cause seizures, breathing difficulty, and death. Edson X. Albuquerque of the University of Maryland School of Medicine in Baltimore and his colleagues used guinea pigs to test the drug galantamine—approved for patients with mild-to-moderate Alzheimer's disease—as an antidote to organophosphorus exposure. The drug and the two nerve agents affect the same enzyme.

The researchers treated some of the animals with galantamine, exposed them to sarin or soman, and then gave them atropine, a drug that's used to reduce some symptoms of organophosphorus exposure. Other animals received atropine only.

All the guinea pigs that received galant-

amine and atropine were alive 24 hours later, while only 11 percent of those treated with just atropine survived.

The researchers also investigated the window of time in which galantamine could be administered and remain effective. They report in an upcoming *Proceedings of the National Academy of Sciences* that all animals survived when treated with galantamine up to 3 hours before or 5 minutes after exposure to soman.

The protective doses of galantamine against organophosphorus poisoning are similar to those already used for Alzheimer's treatment, notes Albuquerque. —A.C.

## BEHAVIOR

### Stress rate revised for Vietnam vets

Inspired by a long-standing controversy over estimates of the number of psychiatric casualties among Vietnam veterans, a research team has determined that overall, about 19 percent of those military personnel developed a serious war-related stress disorder. Furthermore, half of that group still suffered from the condition, post-traumatic stress disorder (PTSD), 11 to 12 years after the war ended in 1975, say psychiatric epidemiologist Bruce P. Dohrenwend of Columbia University and his coworkers.

The scientists reanalyzed data from a 1988 study of 1,200 Vietnam vets. That investigation found that 31 percent of the vets had developed PTSD at some time after their military service and that 15 percent had the disorder at the time of the study. Some researchers have suggested that the national study inflated prevalence rates.

Dohrenwend's group consulted military and historical records to verify vets' reports of war-zone exposure and traumatic events. The investigators also reviewed tape recordings and written records of psychiatric examinations for a representative group of 260 vets from the 1998 sample.

PTSD rates were substantially higher among vets who had been exposed to combat and other traumatic wartime events, the researchers report in the Aug. 18 *Science*. Up to 12 years after having survived extreme dangers, 28 percent of vets had PTSD, compared with 1 percent of vets who had had less exposure to trauma.

Dohrenwend's study demonstrates that the 1988 investigation overestimated the rate of PTSD among Vietnam vets by about 40 percent, remarks Harvard University psychologist Richard J. McNally in an editorial published with the new report.

Some PTSD investigators, such as psy-

chiatrist Arthur Blank Jr. of Bethesda, Md., who directed the 1988 project, contend that the new study underestimates severe stress reactions in Vietnam vets. —B.B.

BIOLOGY

Unusual tumor is contagious in dogs

A type of cancer in dogs is transferred from animal to animal by the exchange of cancer cells, a new study suggests. The results add credence to unusual reports that certain cancers can pass between animals within a species, most notably in Tasmanian devils (SN: 2/4/06, p. 67).

Canine transmissible venereal tumor (CTVT) appears most often in stray dogs. As the name implies, it's considered contagious. However, because cancer generally isn't transmissible, scientists puzzled over the identity of the infectious agent. Some researchers have suspected that a cancer-causing virus plays a role.

To investigate CTVT's cause, Robin Weiss of University College London and his colleagues took tumor and blood samples from 16 dogs identified with the disease. The dogs came from three continents.

They found that in no dog did the tumor's DNA match that in the animal's blood. However, tumor DNA was identical from dog to dog. It also matched the DNA of 40 other CTVT samples stored in veterinary schools on five continents, suggesting that bits of the same tumor had circulated and grown in dogs around the world.

Further examination suggested that the tumor arose at least 200 years ago in a gray wolf or another dog-related species, Weiss' team reports in the Aug. 4 *Cell*. Some quality of that tumor enabled it to be transferred between related species by sexual contact, licking, or biting, the group suggests. —C.B.

TECHNOLOGY

The ups and downs of routing fluids on chips

A new way to build microscale pipes in three dimensions boosts the sophistication of chips that manipulate fluids to perform chemical reactions, biomedical tests, and other tasks, its developers say.

A drawback of most microfluidic chips is that their pipes often intersect because

they're all on one level. So valves must control fluid flows, notes Emil P. Kartalov of the University of Southern California in Los Angeles.

In one established method for making such single-layer chips, a chip builder coats a mold with a thick layer of liquid polymer called polydimethylsiloxane, or PDMS. Ridges in the mold form voids in the polymer that serve as channels for fluids once the material is peeled away and adhered to a glass backing.

In a new study that extends this method to multiple levels, Kartalov and his colleagues devised a simple means to make on-chip pipes that bend upward or downward so that fluids in different pipes can cross without mixing.

In the Aug. 15 *Proceedings of the National Academy of Sciences*, the researchers describe microplumbing made from molds with posts that poke through the liquid-polymer coating. This creates vertical channels through the resulting solid-polymer layer. Next, an additional solidified PDMS structure made on a different mold extends the vertical channels to a second level, where they feed into horizontal pipes again. Stacking up still more levels is possible, Kartalov adds.

The micropipes' vertical jogs "do for microfluidics what overpasses and underpasses do for the highway system," he says. —P.W.

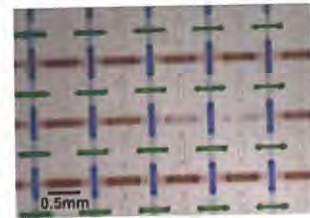
NEUROSCIENCE

Placebo predictions

Clinical trials of antidepressants often start with what's called a placebo lead-in phase. During this brief period, patients receive only inert pills so that their bodies will cleanse themselves of any drugs taken earlier. But placebo lead-in might also help clinicians predict how a patient will respond to actual medication, researchers now report.

Aimee M. Hunter and her colleagues from the University of California, Los Angeles studied 51 adults with major depression. All the patients took an inactive pill daily for a week without knowing it was a placebo. For the next 8 weeks, half the patients received one of two antidepressant medications, fluoxetine or venlafaxine, and the other half received more placebos. At the end of the period, Hunter's team evaluated each patient's depression with a standard clinical test. Some patients in each group had improved.

The researchers also used electroencephalography to examine each patient's



CROSS TRAFFIC Colored and clear fluids in micropipes (seen from above) crisscross without mixing in this two-level chip made with a new method. Green fluid in lower paths was too faint to record.

brain activity before the trial and at several times during the trial.

In both groups, in patients whose depression had improved by the end of the study, neural activity had increased during the placebo lead-in phase, the researchers report in the August *American Journal of Psychiatry*. Whereas that change in medicated patients had appeared in the frontal lobe, patients who received only placebos showed the activity in their right temporal regions.

Clinicians could easily adopt this test, says Hunter. "It might provide information as one indicator of how well we expect a person to respond to medication," she says. —E.J.

NUTRITION

Breast milk may not be enough

A new study finds a high incidence of vitamin D deficiency in breast-fed babies, mostly during winter. Such a deficiency limits the body's use of calcium, which is essential for healthy bones and teeth.

As part of a trial of iron supplementation, Ekhard E. Ziegler of the University of Iowa in Iowa City and his colleagues regularly took blood samples over 2 years from 84 newborns who were initially breastfed exclusively. The researchers noticed that few infants were getting supplemental vitamin D.

The scientists evaluated vitamin D in the infants' blood. They report in the August *Pediatrics* that 78 percent of breastfeeding youngsters not receiving vitamin D in supplements were deficient in that nutrient during winter, but only 4 percent showed the deficiency in summer. None of the 49 infants getting vitamin supplements showed the deficiency at any time.

Iowa's northerly location keeps its residents from getting enough sun exposure in winter to produce much of the vitamin in their skin, the researchers note (SN: 10/16/04, p. 248). Although breast milk delivers vitamin D, mothers in the study were probably deficient in the vitamin during winter.

The current recommended dietary intake of 200 international units per day for nursing women isn't enough, says study coauthor Bruce W. Hollis of the Medical University of South Carolina. His earlier research ([www.sciencenews.org/articles/20050430/food.asp](http://www.sciencenews.org/articles/20050430/food.asp)) suggested that "lactating women need about 6,000 international units a day to ... supply adequate amounts to a nursing infant," he says. —J.R.

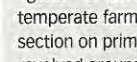
Books

A selection of new and notable books of scientific interest

THE WORLD OF ANCIENT ART

JOHN BOARDMAN

As ancient humans began to manipulate their environment through hunting and gathering, domestication of animals, and the development of farming, they also began to represent this environment through art. Boardman, an art historian and archaeological excavator, emphasizes the influence of geography on this phenomenon. In this book, he surveys the different art styles that emerged in the three "climatic categories" of the ancient world: northern nomadic, temperate farmers, and tropical. He begins with a section on primitive people, whose artistic themes revolved around the animal world and hunting, as seen in cave paintings. The core of the book details the art of the major urban civilizations of antiquity. Art produced during this time included decorated objects used as currency, depictions of religious figures and elements, great temples and building facades, stone carvings, and pottery. Boardman provides a comprehensive overview featuring more than 700 illustrations of various forms of ancient artifacts and artwork. *Thames and Hudson, 2006, 406 p., b&w and color images, hardcover, \$65.00.*



ARCTIC WINGS: Birds of the Arctic National Wildlife Refuge

STEPHEN BROWN, ED.

At the Arctic Wildlife Refuge, more than 190 species of birds converge following epic migrations from six continents. This book, with 200 full-color photos—many covering full pages—depicts waterfowl,



hawks and eagles, shorebirds, gulls, owls, and overwintering birds in their natural splendor. Supplementing these photos is a foreword by former president Jimmy Carter and essays by noted writers, biologists, and conservationists. Writers

include birding-guides author David Allen Sibley, 30-year Alaska resident and author Debbie Miller, *Audubon* magazine editor Kenn Kaufman, and a neighbor of the refuge, Sarah James. The book includes a compact disc containing songs of the birds during breeding season in the refuge. *Mountaineers Books, 2006, 192 p., color photos, hardcover, \$39.95.*

IT'S A JUNGLE UP THERE:

More Tales from the Treetops

MARGARET D. LOWMAN,

EDWARD BURGESS, AND JAMES BURGESS

Many single parents balance successful careers with raising children. Meg Lowman faced and met this challenge in a unique way, by combining her scientific exploration of tree canopies with the nurturing and education of her sons, Edward and James. During her travels with them to the rainforests of Samoa, Peru, Panama, India, and other locales, she instilled in her sons a passion for sci-

ence, exposed them to the diversity of the people of the world, and emphasized the importance of conservation. Lowman details, forthrightly with humor, some of the adventures that she and her boys experienced. Besides sleeping in tree-tops, they encountered shamans performing native rituals and spent time in the artificial environment of Biosphere 2. Edward and James contribute essays that detail their experiences growing up in these unique circumstances and their developing interests in science and conservation. Lowman notes that she hopes that her story will inspire young women who want to pursue science as well as family life. *Yale, 2006, 291 p., b&w images, hardcover, \$27.50.*

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KIDS AND INVENTING:

A Handbook for Young Inventors

SUSAN CASEY

With a great idea, even a kid can be an inventor, according to this book. This educational paperback claims to provide all the know-how needed to bring an idea to fruition and offers dozens of



examples of kids who have already done just that. Casey, an English teacher and author, begins with advice for developing ideas for new inventions. Casey's tips include keeping an inventor's log and writing reports, making models of ideas, and participating in competitions and science fairs. For kids with solid ideas for inventions, the book describes how anyone can search for patents on similar items, apply for a patent, and register for a trademark. Each chapter ends with activities to help kids put the tips into action. Throughout the book are profiles of young people who earned scholarships, recognition, and even wealth for their inventions, including a brake for runaway shopping carts, a spill-proof bowl, and a robot that can aid rescue teams. *Wiley, John & Sons, 2005, 134 p., b&w images, paperback, \$14.95.*

A MADMAN DREAMS OF TURING MACHINES

JANNA LEVIN

In this novel, Levin, an astrophysicist at Columbia University, weaves a tale of the lives of her two favorite mathematicians, Kurt Gödel and Alan Turing. She outlines the early 20th-century youths of



the men—Turing in England and Gödel in Vienna—in parallel narratives that reveal their personalities as Levin imagines them. Gödel, as she portrays him, is a taciturn intellectual "a man who speaks only when spoken to and then only about mathematics,"

whose delusions and paranoia eventually drive him to madness. Turing is also a tormented figure, whose homosexuality makes him an outcast despite his genius. He spends his days asking, "Where is God in 1+1=2?" and questioning his faith. He eventually marries a woman and ponders the intelligence of machines. The two men's narratives eventually intersect. Levin's story will appeal to fans of math history who seek an imaginative perspective on the lives of two of its most interesting characters. *Knopf, 2006, 230 p., hardcover, \$23.95.*

LETTERS

Dust to dust

In "Not a planet?" (SN: 6/17/06, p. 382), Alycia Weinberger says, "The discovery of a disk around the planetary-mass companion to 2M1207 should be a bit of a relief to planet-formation theorists" because it casts doubt on the object being a planet. But wouldn't our early solar system have been composed of at least two planets, Jupiter and Saturn, that had extensive disks around them before their satellites coalesced into moons?

HOWARD ZIMMERMAN, NEW YORK, N.Y.

Researchers say that Jupiter and Saturn indeed had their own disks, but they think that 2M1207 formed as a star in its binary system because it's relatively massive and is far from its partner. —R. COWEN

No jolting news

The possible link between coffee consumption and reduced occurrence of alcohol-related cirrhosis ("Coffee protects against alcoholic cirrhosis," SN: 6/24/06, p. 397) seems worthy of further study. Although the beneficial effect may be due to any of a variety of coffee ingredients, it would seem rather straightforward to investigate a correlation in caffeinated and decaffeinated beverages.

WAYNE H. WARREN JR., GREENBELT, MD.

Since tea consumption didn't appear to have any anticirrhosis effect in the study, the pivotal coffee ingredient doesn't appear to be caffeine. —C. BROWNLEE

Buried information

Information, and especially pictures, of these strange mammals is always of interest ("Naked and Not: Two species of mole rats run complex societies underground," SN: 6/24/06, p. 394). I wanted to check on the statement about "several dozen species in sub-Saharan Africa." Alas, I was unable to do so. *Science News* hadn't bothered to include either generic or specific names for any species discussed. How unfortunate to have this very important piece on Jennifer Jarvis' life's work marred by editorial lapses.

SCOTT MCCLEVE, DOUGLAS, ARIZ.

"Mole rat" is applied to rodents in several families, but the article focused on the Bathyergidae, which includes the Damaraland mole rat (*Cryptomys damarensis*) and the naked mole rat (*Heterocephalus glaber*). Walker's Mammals of the World recognizes 14 species, but Chris Faulkes of the University of London says that DNA evidence supports even more. —S. MILIUS





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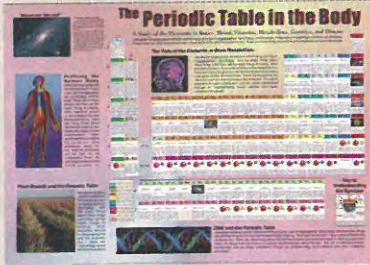
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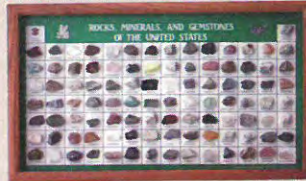


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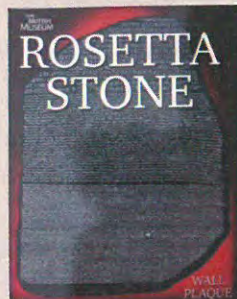


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