



# *Infoteca's E-Journal*



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## In Inner Mongolia, Pushing Architecture's Outer Limits

By FRED A. BERNSTEIN

Ordos, China



ON April 12, Michael Meredith and Hilary Sample, both 36, could have been working in their architecture office in New Haven, worrying about the darkening economic prospects of their profession. Instead, they were in China, presenting a concept for a 10,700-square-foot villa to a client untroubled by thoughts of recession, and being treated like stars. Thanks to a booming economy in this resource-rich desert region of Inner Mongolia, Mr. Meredith said, “we got a little taste of what it’s like to be Zaha Hadid.”

Or maybe one of 100 Zahas. Mr. Meredith and Ms. Sample were part of a large group of mostly up-and-coming design teams from 27 countries that descended on Ordos for five days in April at the behest of a local tycoon. Cai Jiang, who made his money in coal and dairy and has lately turned to real estate, had commissioned 100 firms to design individual houses, each large enough to include amenities like servants’ quarters and indoor pools, as part of a billion-dollar “cultural district” he is building here.

At a time when housing markets across the West are contracting and American architects’ billings are at their lowest point in 12 years, according to the American Institute of Architects, Mr. Cai (pronounced sigh) was offering his guests a rare chance to build big — and paying them, improbably, in wads of cash.

“Basically, Ordos is Texas,” explained Michael S. Tunkey, an American architect based in Shanghai whose firm has designed an opera house that, along with half a dozen museums and a boutique hotel, will anchor Mr. Cai’s new cultural district.



He was referring to the wide open spaces, the frontier attitude and the seemingly endless flow of money (at least in good times) from natural resources. Ordos has rapidly become wealthy, largely because of huge deposits of coal, the primary fuel for China's economic expansion.

Not long ago, residents of this region 350 miles west of Beijing lived in elaborate tents called yurts. Now, with a population of 1.5 million, many live in homes that would make New Yorkers jealous. According to Bao Chongming, the regional vice-mayor, they have the second highest per-capita income in China (trailing only Shanghai, the country's financial capital) and an annual economic growth rate of 40 percent.

Ordos officials decided that the old urban center, Dongsheng, was too crowded, and set out a few years ago to build a new one, Kangbashi, 20 miles away; its population is projected to reach 100,000 by the end of 2008 and five times that number by 2010. And it is sprouting satellite developments, including Mr. Cai's cultural district.

Mr. Cai, who understands a bit of English but speaks through an interpreter, said he conceived the Ordos 100, as the residential development is called, as a way to raise both the region's profile and the aesthetic acumen of its newly affluent residents. At 40, he knows something about the good life he is promoting: he travels by Harley-Davidson or chauffeured Mercedes-Benz, has a mansion in Baotou as well as homes in Beijing and Shanghai, collects contemporary art and is seldom seen without a Cuban cigar.

Born in Baotou, about an hour's drive from Ordos, he got his start trading cashmere and freshwater pearls to Russians for recycled steel and has since diversified into a dozen businesses, he said, including coal mining and dairy farming.

He is clearly a man who knows how to move quickly. In 2007 he approached Jacques Herzog and Pierre de Meuron, the Swiss architects, to help him build 100 houses. (Thanks to their "Bird's Nest" Olympic

stadium in Beijing, Herzog & de Meuron are superstars in China.) Rather than design the villas themselves, Mr. Herzog and Mr. de Meuron opted to enlist 100 firms from around the world, bringing in their friend Ai Weiwei, the well-known Chinese artist, to organize the project.

By the end of December, Mr. Ai's company, Fake Design, had e-mailed the 100 teams, inviting them to come to Ordos — and requesting a response within 10 days. Those who did not answer fast enough were replaced by others on a backup list, said Andy Lee, an American architect who works for Fake Design, on the outskirts of Beijing.



Some of the original 100 picks might have thought the invitation was a hoax, especially given that the e-mail messages were sent by a company called Fake and addressed “Dear Mr/Ms Architect.” Daniel Holguin, a 37-year-old Mexican architect based in Brooklyn, said that when he first heard about the project he wondered if “it was a kind of joke,” and whether there were really 99 others. “But when you’re an architect starting out,” he added, “you have to consider every possibility.”

The list of invitees quickly became a subject of gossip in the architecture world, in part because of its uneven geographic distribution. There are 17 firms from Switzerland, for example, and 9 from Mexico, but only 4 from the United Kingdom and none from China. Mr. Tunkey, whose Yazdani Studio at Cannon Design has designed several buildings for Mr. Cai, said that it would have been better, from a public relations standpoint, if Chinese architects had been included, but the project was moving so fast. “It’s like trying to change directions in the Indy 500,” he said.

A critic quoted in a British newspaper said the low representation of British architects should serve as a wake-up call to that country’s designers. But there was no such concern in the United States, which sent by far the largest contingent: 23 firms — 10 from New York City alone — many with connections to Harvard, where Mr. Herzog and Mr. de Meuron teach.

“It’s not a statement about any country,” Mr. Herzog said. “We had to rely on our network.”



Of the 100 teams that accepted the invitation, 28 flew to Ordos in January, to see the site and to meet the client; they returned in April with models of their villas. (The site plan for the neighborhood was designed by Mr. Ai.) “For young architects who don’t usually get to build very much” — even in good economic times — “this is monumental,” said Mr. Meredith, who arrived from New York with Ms. Sample and a 1/100 scale model of their villa.

Mr. Cai appeared genuinely interested in the architecture he was shown, studying models with Mr. Ai and consulting with engineers about how to get the houses built efficiently. He estimated construction costs at \$30 a square foot — about a tenth of what they would be in a major American city — thanks to the seemingly unlimited supply of workers who leave their families on farms in surrounding provinces to live in dormitories here. (One afternoon during the architects’ visit, several workers digging a well on the Ordos 100 site were asked how much they were paid, and shouted back, in Chinese, “Eight hundred yuan a month,” or about \$115.)

A few hours after the first 28 teams presented their designs, 69 more arrived (a final three were selected later, making an even 100). The five-day junket that followed included trips to the site, a dinner in a giant yurt near Genghis Khan’s tomb (Mr. Cai, who is ethnically Mongolian, claims Genghis Khan as an ancestor) and karaoke in the bar of the Holiday Inn, a lavish hotel that bears no resemblance to Holiday Inns in the United States.

At times, as the black-clad architects made their way around the barren landscape, it was hard for some to escape the feeling that the entire event was a kind of performance, with architects as hired players. Last year Mr. Ai sent 1,001 Chinese citizens to Kassel, Germany, where they lived on cots during the Documenta art fair. “Are we just performers in another of Weiwei’s pieces?” said Keller Easterling, 49, an architecture professor at Yale and a practitioner based in Manhattan.

The effect was heightened by the presence of camera crews — one making a documentary for Mr. Ai, another making a documentary for Mr. Cai, and many others taping the event for Chinese television. Everywhere the architects traveled, their parade of gold-colored Mercedes buses had police escorts, which served no purpose other than to emphasize something that was obvious from the presence of numerous public officials at the Holiday Inn: that Mr. Cai has government support for the Ordos 100 project.

On the third day there was an elaborate ceremony in which the 69 new teams picked numbers out of a box, with each number representing a building lot. For architects used to competing for the chance to build, it was a highlight of the visit, second only to the distribution, on the last day, of cash payments in thick envelopes — \$12,500 for each of the 28 initial teams, and first payments of \$14,300 for the new ones. (Each firm's fee for the project will total about \$36,000.) Mr. Cai said he expected to sell the villas — which he promised to have built by the end of 2009 — for about \$1.5 million each. He said he had interest from local businessmen who would use them as residences or as second homes for entertaining clients.

Many of the architects seemed almost giddy to be freed from the constraints they face in their home cities, where historic preservation laws combined with the scarcity of building sites means that they seldom get to design buildings from the ground up. Daniel Rosbottom, a 38-year-old partner in DRDH Architects in London, described that city as “a difficult climate for young architects,” and Ordos as “a fantastic opportunity to build a quite substantial building really quickly.”



Later, though, at least one of the initial 28 — Lyn Rice, an established New York architect with more experience than many of the others — noted a downside to all the freedom. “If I were approached by a genie and told, you’ve got three wishes, they would be, one, for a project that moves along fast; two, that I don’t need to do construction documents; and three, that I have a client who doesn’t worry too much about what I do.”

But faced with that reality in China, Mr. Rice remembered that “it’s the restrictions that force a project to go deeper” — to become aesthetically and functionally richer and more exciting. Mr. Ai, as the client’s representative, had offered “very few comments about our schematic proposal” in April, Mr. Rice said. Without that kind of client pushback, he added, “you feel a little naked.”

Others among the 100 raised different issues. Some said they felt uncomfortable being used by Mr. Cai to draw attention to a vast real estate development, of which the 100 houses are only a small part. (There will eventually be 2,500 residential units, he said.) Others said they felt as if they were there, if not as performers in an Ai Weiwei piece, then to entertain Mr. Ai, who clearly relished the chance to conduct an orchestra of 100 architects-of-the-moment. Mr. Ai, whose art works sell for millions of dollars, has worked on important Chinese buildings himself, but said he is involved in architecture “as a hobby.”



For days, in conference rooms at the Holiday Inn, the group struggled with questions like who will live in the houses and why the houses have to be so big. Several talked about the negative environmental impact of such large houses, but were unable to get firm answers to questions about where water and electricity would come from. (Mr. Cai said that some power would come from an array of solar panels near the site, that a few of the houses would have geothermal wells, and that by planting thousands of trees on the site he was helping to reverse desertification.)

Many architects were worried about the way the project broke from their usual way of working “with context, with a desire to make buildings that are part of the connective tissue of the city,” as Mr. Rosbottom put it. In Ordos, the buildings will stand alone, “100 sculptures competing for attention,” said Preston Scott Cohen, 46, an architect in Cambridge, Mass., and a professor at Harvard, on a cluster of lots ranging from just a quarter-acre to a half-acre. He proposed that there be restrictions on materials and colors, so that the houses would form a coherent whole, but Mr. Ai and the other organizers politely ignored the suggestion.



Mr. Ai, who is known as a provocateur, encouraged the architects to keep asking questions, though he rarely provided answers.



But he did offer some specific comments on the houses by the first 28 teams. At one point, he told Mr. Meredith and Ms. Sample that a garage building on their property seemed a bit too big and would overpower a neighboring house. “Why don’t you take some time and see if you can adjust it,” he said gently.

But they didn’t need time. Mr. Meredith simply reached over to the cardboard model and ripped the garage off its base, exposing a patch of blue cardboard.

“Good, a swimming pool,” said Mr. Ai, smiling.

He was less impressed with the few houses that had curved walls meant to evoke yurts. “When I see that, I have to take it as a joke,” he said later. After all, Ordos is hardly a tent city. Indeed, Mr. Ai said, pointing to the architects who had traveled thousands of miles looking for work: “These days, it’s the architects, dressed in black, who are the tribe of nomads.”

<http://www.nytimes.com/2008/05/01/garden/01mongolia.html?ref=design>

**'WATERMILL'****A Dream Landscape Littered With the Poet-Hero's Memories****By ALASTAIR MACAULAY**

When Jerome Robbins returned to ballet in 1969, he seemed determined to prove he was a grand master and no longer the charming laugh-monger of old. Several of the works he choreographed in the following years — “Dances at a Gathering” (1969), “The Goldberg Variations” (1971), “Watermill” (1972), “Dybbuk” (1974) — were surely aimed at the “magnum opus” category.

Unlike “Dances” but like the each very different “Goldberg” and “Dybbuk,” “Watermill” — which returned to New York City Ballet repertory on Friday night — is concept-heavy, serious as all hell and seldom rewarding. This was Robbins’s venture into psychedelic changes of perception (the biographies tell us he had a disturbing drug-related experience in Watermill, N.Y.), Robert Wilson music-theater territory, aspects of Japanese Noh and unconventional uses of time, mostly of slow motion. It must be the least dancey dance he ever made.

The first quarter-hour or more of “Watermill” demonstrates mastery enough on Robbins’s part. He shows the male protagonist, gives us a dream landscape — dim light, giant sheaves of rushes or hemp — and suggests that this lone poet-hero is newly vulnerable. (He removes his cloak and almost all his clothes.) Robbins also establishes that most of the piece will be slow (like a drugged memory), lets us feel that this man is also (like the heroine of one of Martha Graham’s later “psychological” dramas) looking back on various events of his life, and plays skillfully with contrasted speeds.



When one young man and his friends move fast, we can tell they're a memory of youth; when the hero rushes around the stage, by contrast, we know he's striving to control his visions. It's not unreasonable to guess that two or three of the other men we see are versions of the hero in different phases of life. The Asian music, by Teijo Ito, is played by six musicians sitting along the side of the apron of the stage; Japanese lanterns are among the stage properties used.

Then "Watermill" runs aground, curiously just as it reaches the material that ought to be most dramatically important. Our hero, numb, watches an intensely sexual male-female pas de deux take place in slow motion, as if clinically anatomized. This ought to matter, but by this point Robbins's rhythm has become too dull.

"I am weary of this moon," Hippolyta says in "A Midsummer Night's Dream." "Would he would change!" But the moon on the "Watermill" backdrop changes several times, as do the events and characters onstage, and I stayed weary. Nikolaj Hübbe has returned to City Ballet to play the central figure; I wish I could be grateful.

"Watermill" shows one kind of cycle. So does this program's other offering, "The Four Seasons," which I reviewed last week. It reveals another face of Robbins altogether: pure-dance classicism touched by caricature phrasing, and happy to entertain. In Friday's performance, just as I was thinking that the "Fall" ballerina is the role that currently suits Ashley Bouder least (for all her brilliant control, it makes her look posy and knowing), she threw one or two thunderbolts that jolted the ballet onto another, higher, plane of sensation.

*The New York City Ballet season continues through June 29 at the New York State Theater, Lincoln Center; (212) 870-5570, nycballet.com. The "Seasons" double bill runs in repertory until May 8.*

<http://www.nytimes.com/2008/05/05/arts/dance/05seas.html?ref=dance>



## Study Finds That Fat Cells Die and Are Replaced

By GINA KOLATA

Every year, whether you are fat or thin, whether you lose weight or gain, 10 percent of your fat cells die. And every year, those cells that die are replaced with new fat cells, researchers in Sweden reported Sunday.

The result is that the total number of fat cells in the body remains the same, year after year throughout adulthood. Losing or gaining weight affects only the amount of fat stored in the cells, not the number of cells.

The finding was published online Sunday in the journal *Nature*.

Obesity investigators say the study raises tantalizing questions: What determines how many fat cells are in a person's body? When is that number determined? Is there a way to intervene so people end up with fewer fat cells when they reach adulthood? And could obesity be treated by making fat cells die faster than they are born?

"This is a new way of looking at obesity," said Dr. Lester Salans, an obesity researcher and emeritus professor at Mount Sinai School of Medicine in New York.

But for now, researchers say, they do not have a clue about how to answer those questions.

"There is a system waiting to be discovered," said Dr. Jeffrey S. Flier, an obesity researcher and dean of Harvard Medical School.

Dr. Flier and other obesity researchers cautioned, though, that even if scientists knew how the fat cell system worked, it was not clear that it would be safe or effective to treat obesity by intervening. One of the hard lessons of the past couple of decades has been that the body has redundant controls to maintain weight.

"I suspect that the body's regulation of weight is so complex that if you intervene at this site, something else is going to happen to neutralize this intervention," Dr. Salans said.

But the discovery is also leading to new ways to address other questions about obesity. For example, what happens to people who are thin until adulthood and then gain a lot of weight? The study focused on people who had been fat since childhood, the usual route for adult obesity. The situation may be different for people who got fat later. They may actually grow new fat cells — the ones they had may have become so stuffed with fat that they could hold no more.

Another question is whether fat cells removed with liposuction grow back.

Both questions are now under investigation by the Swedish researchers.

In a way, Dr. Flier noted, the discovery is a sort of back-to-the-future moment. There was a time a few decades ago, before the current interest in how the brain regulates how much is eaten, when obesity researchers spent all their time studying and discussing fat cells. Investigators discovered that fat people had more fat cells than thin people and that fat cells shrank with weight loss and bulged with weight gain.

Dr. Jules Hirsch of Rockefeller University in New York, who did many of the initial studies with humans, said he started because he could not understand why people who lost weight regained. "They should have been cured," Dr. Hirsch said. After all, he said, if you cut out a fatty tumor, the fat does not grow back. Why was fat lost from dieting different?



The result was the fat cell hypothesis, a notion that obsessed researchers. Fat cells, the hypothesis said, are laid down early in life and after that, they can change only in size, not in number. When people lose weight and their fat cells shrink, that creates a signal to fill the cells again, making people regain. “We didn’t know a lot about obesity, so that was what we talked about,” Dr. Flier said.

But the discussions stalled. It was not clear what to do about those discoveries or what they meant to efforts to help people lose weight. And no one had a method to ask whether fat cells were being created and destroyed during life. Few even thought to ask that question.

That changed only recently when the new paper’s first author, Kirsty L. Spalding, a neurobiologist at the Karolinska Institute in Sweden, developed a way to ask whether new cells grow in the cortical and cerebellum regions of the human brain. She found no new cells there since birth. One day, she was giving a talk on her brain study when a scientist in the audience, Erik Arner, suggested she use the method to look at fat cells. (Dr. Arner is the second author of Dr. Spalding’s paper.) The method for dating human cells takes advantage of an effect caused by above-ground nuclear bomb testing that took place from 1955 to 1963.

When the bombs were tested, their radioactivity created a spike in the amount of a carbon isotope, C14, in the atmosphere. The C14 made its way into plants and animals that ate the plants. When people ate those plants and meat from the animals, the C14 was incorporated into their human DNA. After the nuclear test ban, C14 levels started to drop. The result is that every cell has a C14 level that reflects the level in the atmosphere at the time the cell was born.

“Each cell is a time capsule of sorts,” Dr. Spalding said.

First the researchers confirmed that the number of fat cells remained constant in adults. Obese people who had weight loss surgery had as many fat cells two years after the surgery as before it, even though they were much thinner.

Then the investigators asked whether fat cells were being born and dying. To do that, they examined fat cells taken from 35 people, fat and lean, who had had liposuction or abdominal wall reconstruction. The amount of C14 in the cells would reveal how old the cells were. Since the number of fat cells remained constant, the number being born had to equal the number dying. And a mathematical model would reveal the dynamics of the cell turnover.

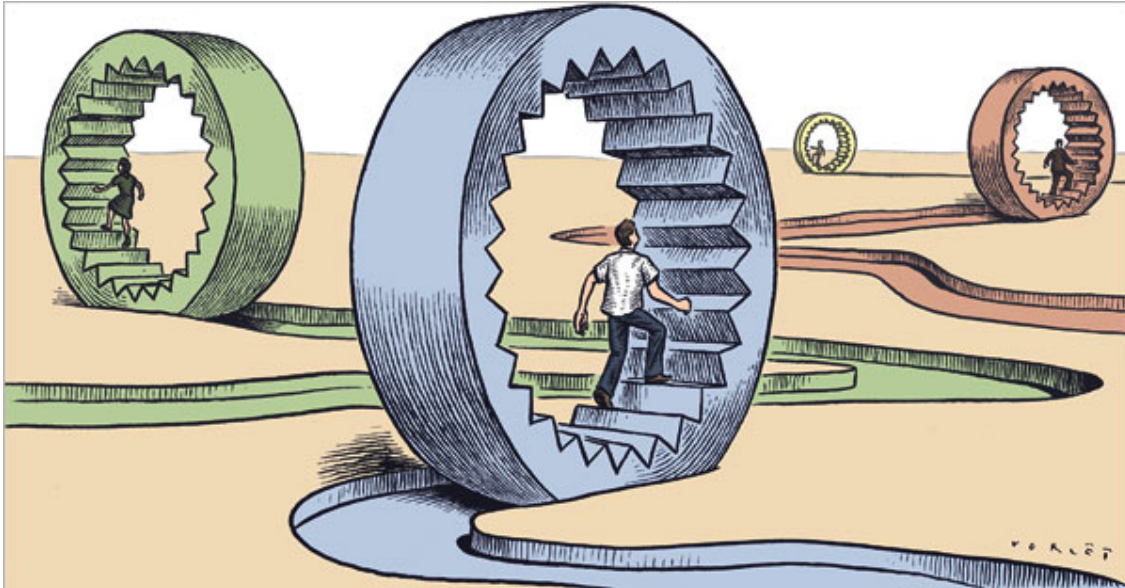
“We found the cells were really quite young,” Dr. Spalding said. “That tells us new cells are being born.”

She added: “The million-dollar question now is, What regulates this process? And where can we intervene?”

<http://www.nytimes.com/2008/05/05/health/research/05fat.html?ref=science>

## Can You Become a Creature of New Habits?

By JANET RAE-DUPREE



HABITS are a funny thing. We reach for them mindlessly, setting our brains on auto-pilot and relaxing into the unconscious comfort of familiar routine. “Not choice, but habit rules the unreflecting herd,” William Wordsworth said in the 19th century. In the ever-changing 21st century, even the word “habit” carries a negative connotation.

So it seems antithetical to talk about habits in the same context as creativity and innovation. But brain researchers have discovered that when we consciously develop new habits, we create parallel synaptic paths, and even entirely new brain cells, that can jump our trains of thought onto new, innovative tracks.

Rather than dismissing ourselves as unchangeable creatures of habit, we can instead direct our own change by consciously developing new habits. In fact, the more new things we try — the more we step outside our comfort zone — the more inherently creative we become, both in the workplace and in our personal lives. But don’t bother trying to kill off old habits; once those ruts of procedure are worn into the hippocampus, they’re there to stay. Instead, the new habits we deliberately ingrain into ourselves create parallel pathways that can bypass those old roads.

“The first thing needed for innovation is a fascination with wonder,” says Dawna Markova, author of “The Open Mind” and an executive change consultant for Professional Thinking Partners. “But we are taught instead to ‘decide,’ just as our president calls himself ‘the Decider.’ ” She adds, however, that “to decide is to kill off all possibilities but one. A good innovational thinker is always exploring the many other possibilities.” All of us work through problems in ways of which we’re unaware, she says. Researchers in the late 1960s discovered that humans are born with the capacity to approach challenges in four primary ways: analytically, procedurally, relationally (or collaboratively) and innovatively. At puberty, however, the brain shuts down half of that capacity, preserving only those modes of thought that have seemed most valuable during the first decade or so of life.

The current emphasis on standardized testing highlights analysis and procedure, meaning that few of us inherently use our innovative and collaborative modes of thought. “This breaks the major rule in the American belief system — that anyone can do anything,” explains M. J. Ryan, author of the 2006 book “This Year I Will...” and Ms. Markova’s business partner. “That’s a lie that we have perpetuated, and it fosters mediocrity. Knowing what you’re good at and doing even more of it creates excellence.”



This is where developing new habits comes in. If you're an analytical or procedural thinker, you learn in different ways than someone who is inherently innovative or collaborative. Figure out what has worked for you when you've learned in the past, and you can draw your own map for developing additional skills and behaviors for the future.

"I apprentice myself to someone when I want to learn something new or develop a new habit," Ms. Ryan says. "Other people read a book about it or take a course. If you have a pathway to learning, use it because that's going to be easier than creating an entirely new pathway in your brain."

Ms. Ryan and Ms. Markova have found what they call three zones of existence: comfort, stretch and stress. Comfort is the realm of existing habit. Stress occurs when a challenge is so far beyond current experience as to be overwhelming. It's that stretch zone in the middle — activities that feel a bit awkward and unfamiliar — where true change occurs.

"Getting into the stretch zone is good for you," Ms. Ryan says in "This Year I Will... ." "It helps keep your brain healthy. It turns out that unless we continue to learn new things, which challenges our brains to create new pathways, they literally begin to atrophy, which may result in dementia, Alzheimer's and other brain diseases. Continuously stretching ourselves will even help us lose weight, according to one study. Researchers who asked folks to do something different every day — listen to a new radio station, for instance — found that they lost and kept off weight. No one is sure why, but scientists speculate that getting out of routines makes us more aware in general."

She recommends practicing a Japanese technique called kaizen, which calls for tiny, continuous improvements.

"Whenever we initiate change, even a positive one, we activate fear in our emotional brain," Ms. Ryan notes in her book. "If the fear is big enough, the fight-or-flight response will go off and we'll run from what we're trying to do. The small steps in kaizen don't set off fight or flight, but rather keep us in the thinking brain, where we have access to our creativity and playfulness."

Simultaneously, take a look at how colleagues approach challenges, Ms. Markova suggests. We tend to believe that those who think the way we do are smarter than those who don't. That can be fatal in business, particularly for executives who surround themselves with like-thinkers. If seniority and promotion are based on similarity to those at the top, chances are strong that the company lacks intellectual diversity.

"Try lacing your hands together," Ms. Markova says. "You habitually do it one way. Now try doing it with the other thumb on top. Feels awkward, doesn't it? That's the valuable moment we call confusion, when we fuse the old with the new."

AFTER the churn of confusion, she says, the brain begins organizing the new input, ultimately creating new synaptic connections if the process is repeated enough.

But if, during creation of that new habit, the "Great Decider" steps in to protest against taking the unfamiliar path, "you get convergence and we keep doing the same thing over and over again," she says.

"You cannot have innovation," she adds, "unless you are willing and able to move through the unknown and go from curiosity to wonder."

*Janet Rae-Dupree writes about science and emerging technology in Silicon Valley.*

<http://www.nytimes.com/2008/05/04/business/04unbox.html?ref=science>

## Pursuing the Next Level of Artificial Intelligence

By **JOHN MARKOFF**



PALO ALTO, Calif. — Like a good gambler, Daphne Koller, a researcher at Stanford whose work has led to advances in artificial intelligence, sees the world as a web of probabilities.

There is, however, nothing uncertain about her impact.

A mathematical theoretician, she has made contributions in areas like robotics and biology. Her biggest accomplishment — and at age 39, she is expected to make more — is creating a set of computational tools for artificial intelligence that can be used by scientists and engineers to do things like predict traffic jams, improve machine vision and understand the way cancer spreads.

Ms. Koller's work, building on an 18th-century theorem about probability, has already had an important commercial impact, and her colleagues say that will grow in the coming decade. Her techniques have been used to improve computer vision systems and in understanding natural language, and in the future they are expected to lead to an improved generation of Web search.

"She's on the bleeding edge of the leading edge," said Gary Bradski, a machine vision researcher at Willow Garage, a robotics start-up firm in Menlo Park, Calif.

Ms. Koller was honored last week with a new computer sciences award sponsored by the Association for Computing Machinery and the Infosys Foundation, the philanthropic arm of the Indian computer services firm Infosys.

The award to Ms. Koller, with a prize of \$150,000, is viewed by scientists and industry executives as validating her research, which has helped transform artificial intelligence from science fiction and speculation into an engineering discipline that is creating an array of intelligent machines and systems. It is not the first such recognition; in 2004, Ms. Koller received a \$500,000 MacArthur Fellowship.

Ms. Koller is part of a revival of interest in artificial intelligence. After three decades of disappointments, artificial intelligence researchers are making progress. Recent developments made possible spam filters,





Microsoft's new ClearFlow traffic maps and the driverless robotic cars that Stanford teams have built for competitions sponsored by the Defense Advanced Research Projects Agency.

Since arriving at Stanford as a professor in 1995, Ms. Koller has led a group of researchers who have reinvented the discipline of artificial intelligence. Pioneered during the 1960s, the field was originally dominated by efforts to build reasoning systems from logic and rules. Judea Pearl, a computer scientist at the University of California, Los Angeles, had a decade earlier advanced statistical techniques that relied on repeated measurements of real-world phenomena.

Called the Bayesian approach, it centers on a formula for updating the probabilities of events based on repeated observations. The Bayes rule, named for the 18th-century mathematician Thomas Bayes, describes how to transform a current assumption about an event into a revised, more accurate assumption after observing further evidence.

Ms. Koller has led research that has greatly increased the scope of existing Bayesian-related software. "When I started in the mid- to late 1980s, there was a sense that numbers didn't belong in A.I.," she said in a recent interview. "People didn't think in numbers, so why should computers use numbers?"

Ms. Koller is beginning to apply her algorithms more generally to help scientists discern patterns in vast collections of data.

"The world is noisy and messy," Ms. Koller said. "You need to deal with the noise and uncertainty."

That philosophy has led her to do research in game theory and artificial intelligence, and more recently in molecular biology.

Her tools led to a new type of cancer gene map based on examining the behavior of a large number of genes that are active in a variety of tumors. From the research, scientists were able to develop a new explanation of how breast tumors spread into bone.

One potentially promising area to apply Ms. Koller's theoretical work will be the emerging field of information extraction, which could be applied to Web searches. Web pages would be read by software systems that could organize the information and effectively understand unstructured text.

"Daphne is one of the most passionate researchers in the A.I. community," said Eric Horvitz, a Microsoft researcher and president of the Association for the Advancement of Artificial Intelligence. "After being immersed for a few years with the computational challenges of decoding regulatory genomics, she confided her excitement to me, saying something like, 'I think I've become a biologist — I mean a real biologist — and it's fabulous.'"

To that end, Ms. Koller is spending a sabbatical doing research with biologists at the University of California, San Francisco. Because biology is increasingly computational, her expertise is vital in gaining deeper understanding of cellular processes.

Ms. Koller grew up in an academic family in Israel, the daughter of a botanist and an English professor. While her father spent a year at Stanford in 1981 when she was 12, she began programming on a Radio Shack PC that she shared with another student.

When her family returned to Israel the next year, she told her father, the botanist, that she was bored with high school and wanted to pursue something more stimulating in college. After half a year, she persuaded him to let her enter Hebrew University, where she studied computer science and mathematics.



By 17, she was teaching a database course at the university. The next year she received her master's degree and then joined the Israeli Army before coming to the United States to study for a Ph.D. at Stanford.

She didn't spend her time looking at a computer monitor. "I find it distressing that the view of the field is that you sit in your office by yourself surrounded by old pizza boxes and cans of Coke, hacking away at the bowels of the Windows operating system," she said. "I spend most of my time thinking about things like how does a cell work or how do we understand images in the world around us?"

In recent years, many of her graduate students have gone to work at Google. However she tries to persuade undergraduates to stay in academia and not rush off to become software engineers at start-up companies.

She acknowledges that the allure of Silicon Valley riches can be seductive. "My husband still berates me for not having jumped on the Google bandwagon at the beginning," she said. Still, she insists she does not regret her decision to stay in academia. "I like the freedom to explore the things I care about," she said.

<http://www.nytimes.com/2008/05/03/technology/03koller.html?ref=science>

## Want to Remember Everything You'll Ever Learn? Surrender to This Algorithm

By Gary Wolf  04.21.08 | 6:00 PM



*Illustration: Steven Wilson*

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### **THE MEMORY MASTER:** [Want to Remember Everything You'll Ever Learn? Surrender to This Algorithm.](#)

**The winter sun sets** in mid-afternoon in Kolobrzeg, Poland, but the early twilight does not deter people from taking their regular outdoor promenade. Bundled up in parkas with fur-trimmed hoods, strolling hand in mittened hand along the edge of the Baltic Sea, off-season tourists from Germany stop openmouthed when they see a tall, well-built, nearly naked man running up and down the sand.

"*Kalt? Kalt?*" one of them calls out. The man gives a polite but vague answer, then turns and dives into the waves. After swimming back and forth in the 40-degree water for a few minutes, he emerges from the surf and jogs briefly along the shore. The wind is strong, but the man makes no move to get dressed.



Passersby continue to comment and stare. "This is one of the reasons I prefer anonymity," he tells me in English. "You do something even slightly out of the ordinary and it causes a sensation."

Piotr Wozniak's quest for anonymity has been successful. Nobody along this string of little beach resorts recognizes him as the inventor of a technique to turn people into geniuses. A portion of this technique, embodied in a software program called SuperMemo, has enthusiastic users around the world. They apply it mainly to learning languages, and it's popular among people for whom fluency is a necessity — students from Poland or other poor countries aiming to score well enough on English-language exams to study abroad. A substantial number of them do not pay for it, and pirated copies are ubiquitous on software bulletin boards in China, where it competes with knockoffs like SugarMemo.

SuperMemo is based on the insight that there is an ideal moment to practice what you've learned. Practice too soon and you waste your time. Practice too late and you've forgotten the material and have to relearn it. The right time to practice is just at the moment you're about to forget. Unfortunately, this moment is different for every person and each bit of information. Imagine a pile of thousands of flash cards. Somewhere in this pile are the ones you should be practicing right now. Which are they?

Fortunately, human forgetting follows a pattern. We forget exponentially. A graph of our likelihood of getting the correct answer on a quiz sweeps quickly downward over time and then levels off. This pattern has long been known to cognitive psychology, but it has been difficult to put to practical use. It's too complex for us to employ with our naked brains.

Twenty years ago, Wozniak realized that computers could easily calculate the moment of forgetting if he could discover the right algorithm. SuperMemo is the result of his research. It predicts the future state of a person's memory and schedules information reviews at the optimal time. The effect is striking. Users can seal huge quantities of vocabulary into their brains. But for Wozniak, 46, helping people learn a foreign language fast is just the tiniest part of his goal. As we plan the days, weeks, even years of our lives, he would have us rely not merely on our traditional sources of self-knowledge — introspection, intuition, and conscious thought — but also on something new: predictions about ourselves encoded in machines.

Given the chance to observe our behaviors, computers can run simulations, modeling different versions of our path through the world. By tuning these models for top performance, computers will give us rules to live by. They will be able to tell us when to wake, sleep, learn, and exercise; they will cue us to remember what we've read, help us track whom we've met, and remind us of our goals. Computers, in Wozniak's scheme, will increase our intellectual capacity and enhance our rational self-control.

The reason the inventor of SuperMemo pursues extreme anonymity, asking me to conceal his exact location and shunning even casual recognition by users of his software, is not because he's paranoid or a misanthrope but because he wants to avoid random interruptions to a long-running experiment he's conducting on himself. Wozniak is a kind of algorithmic man. He's exploring what it's like to live in strict obedience to reason. On first encounter, he appears to be one of the happiest people I've ever met.

**In the late 1800s**, a German scientist named Hermann Ebbinghaus made up lists of nonsense syllables and measured how long it took to forget and then relearn them. (Here is an example of the type of list he used: bes dek fel gup huf jeik mek meun pon daus dor gim ke4k be4p bCn hes.) In experiments of breathtaking rigor and tedium, Ebbinghaus practiced and recited from memory 2.5 nonsense syllables a second, then rested for a bit and started again. Maintaining a pace of rote mental athleticism that all students of foreign verb conjugation will regard with awe, Ebbinghaus trained this way for more than a year. Then, to show that the results he was getting weren't an accident, he repeated the entire set of experiments three years later. Finally, in 1885, he published a monograph called *Memory: A Contribution to Experimental Psychology*. The book became the founding classic of a new discipline.

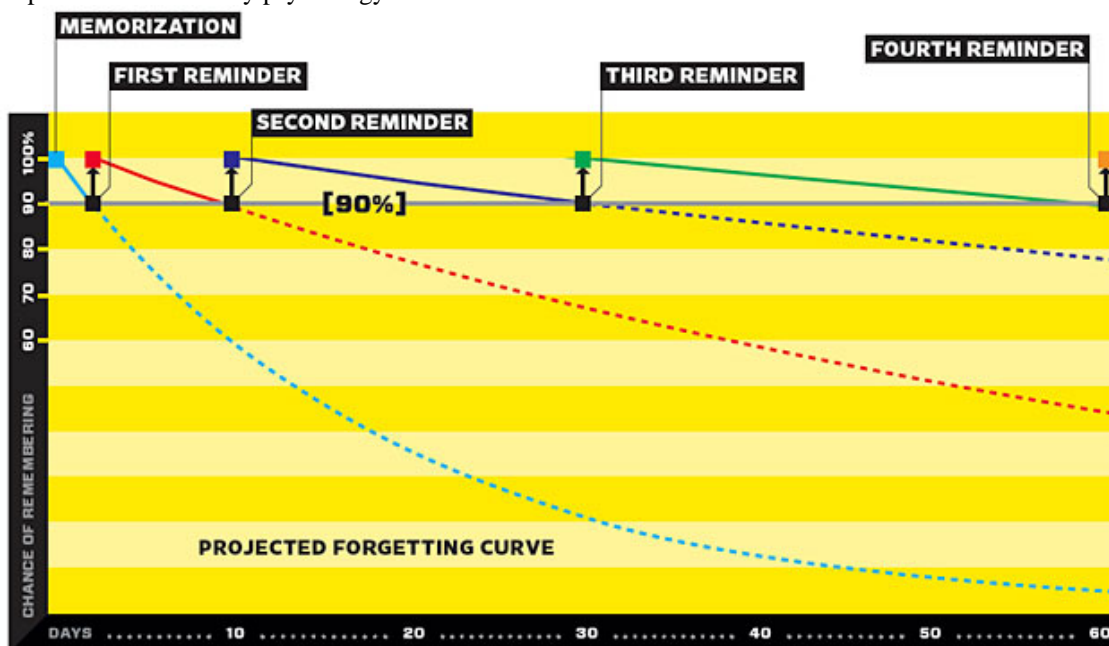
Ebbinghaus discovered many lawlike regularities of mental life. He was the first to draw a learning curve. Among his original observations was an account of a strange phenomenon that would drive his successors half batty for the next century: the spacing effect.

Ebbinghaus showed that it's possible to dramatically improve learning by correctly spacing practice sessions. On one level, this finding is trivial; all students have been warned not to cram. But the efficiencies created by precise spacing are so large, and the improvement in performance so predictable, that from nearly the moment Ebbinghaus described the spacing effect, psychologists have been urging educators to use it to accelerate human progress. After all, there is a tremendous amount of material we might want to know. Time is short.

### How Supermemo Works

SuperMemo is a program that keeps track of discrete bits of information you've learned and want to retain. For example, say you're studying Spanish. Your chance of recalling a given word when you need it declines over time according to a predictable pattern. SuperMemo tracks this so-called forgetting curve and reminds you to rehearse your knowledge when your chance of recalling it has dropped to, say, 90 percent. When you first learn a new vocabulary word, your chance of recalling it will drop quickly. But after SuperMemo reminds you of the word, the rate of forgetting levels out. The program tracks this new decline and waits longer to quiz you the next time.

However, this technique never caught on. The spacing effect is "one of the most remarkable phenomena to emerge from laboratory research on learning," the psychologist Frank Dempster wrote in 1988, at the beginning of a typically sad encomium published in *American Psychologist* under the title "The Spacing Effect: A Case Study in the Failure to Apply the Results of Psychological Research." The sorrowful tone is not hard to understand. How would computer scientists feel if people continued to use slide rules for engineering calculations? What if, centuries after the invention of spectacles, people still dealt with nearsightedness by holding things closer to their eyes? Psychologists who studied the spacing effect thought they possessed a solution to a problem that had frustrated humankind since before written language: how to remember what's been learned. But instead, the spacing effect became a reminder of the impotence of laboratory psychology.



As a student at the Poznan University of Technology in western Poland in the 1980s, Wozniak was overwhelmed by the sheer number of things he was expected to learn. But that wasn't his most troubling problem. He wasn't just trying to pass his exams; he was trying to learn. He couldn't help noticing that within a few months of completing a class, only a fraction of the knowledge he had so painfully acquired remained in his mind. Wozniak knew nothing of the spacing effect, but he knew that the methods at hand didn't work.



The most important challenge was English. Wozniak refused to be satisfied with the broken, half-learned English that so many otherwise smart students were stuck with. So he created an analog database, with each entry consisting of a question and answer on a piece of paper. Every time he reviewed a word, phrase, or fact, he meticulously noted the date and marked whether he had forgotten it. At the end of the session, he tallied the number of remembered and forgotten items. By 1984, a century after Ebbinghaus finished his second series of experiments on nonsense syllables, Wozniak's database contained 3,000 English words and phrases and 1,400 facts culled from biology, each with a complete repetition history. He was now prepared to ask himself an important question: How long would it take him to master the things he wanted to know?

The answer: too long. In fact, the answer was worse than too long. According to Wozniak's first calculations, success was impossible. The problem wasn't learning the material; it was retaining it. He found that 40 percent of his English vocabulary vanished over time. Sixty percent of his biology answers evaporated. Using some simple calculations, he figured out that with his normal method of study, it would require two hours of practice every day to learn and retain a modest English vocabulary of 15,000 words. For 30,000 words, Wozniak would need twice that time. This was impractical.

Wozniak's discouraging numbers were roughly consistent with the results that Ebbinghaus had recorded in his own experiments and that have been confirmed by other psychologists in the decades since. If students nonetheless manage to become expert in a few of the things they study, it's not because they retain the material from their lessons but because they specialize in a relatively narrow subfield where intense practice keeps their memory fresh. When it comes to language, the received wisdom is that immersion — usually amounting to actual immigration — is necessary to achieve fluency. On one hand, this is helpful advice. On the other hand, it's an awful commentary on the value of countless classroom hours. Learning things is easy. But remembering them — this is where a certain hopelessness sets in.

As Wozniak later wrote in describing the failure of his early learning system: "The process of increasing the size of my databases gradually progressed at the cost of knowledge retention." In other words, as his list grew, so did his forgetting. He was climbing a mountain of loose gravel and making less and less progress at each step.

**The problem of forgetting** might not torment us so much if we could only convince ourselves that remembering isn't important. Perhaps the things we learn — words, dates, formulas, historical and biographical details — don't really matter. Facts can be looked up. That's what the Internet is for. When it comes to learning, what really matters is how things fit together. We master the stories, the schemas, the frameworks, the paradigms; we rehearse the lingo; we swim in the episteme.

The disadvantage of this comforting notion is that it's false. "The people who criticize memorization — how happy would they be to spell out every letter of every word they read?" asks Robert Bjork, chair of UCLA's psychology department and one of the most eminent memory researchers. After all, Bjork notes, children learn to read whole words through intense practice, and every time we enter a new field we become children again. "You can't escape memorization," he says. "There is an initial process of learning the names of things. That's a stage we all go through. It's all the more important to go through it rapidly." The human brain is a marvel of associative processing, but in order to make associations, data must be loaded into memory.

Once we drop the excuse that memorization is pointless, we're left with an interesting mystery. Much of the information does remain in our memory, though we cannot recall it. "To this day," Bjork says, "most people think about forgetting as decay, that memories are like footprints in the sand that gradually fade away. But that has been disproved by a lot of research. The memory appears to be gone because you can't recall it, but we can prove that it's still there. For instance, you can still recognize a 'forgotten' item in a group. Yes, without continued use, things become inaccessible. But they are not gone."

After an ichthyologist named David Starr Jordan became the first president of Stanford University in the 1890s, he bequeathed to memory researchers one of their favorite truisms: Every time he learned the

name of a student, Jordan is said to have complained, he forgot the name of a fish. But the fish to which Jordan had devoted his research life were still there, somewhere beneath the surface of consciousness. The difficulty was in catching them.

During the years that Wozniak struggled to master English, Bjork and his collaborator, Elizabeth Bjork (she is also a professor of psychology; the two have been married since 1969), were at work on a new theory of forgetting. Both were steeped in the history of laboratory research on memory, and one of their goals was to get to the bottom of the spacing effect. They were also curious about the paradoxical tendency of older memories to become stronger with the passage of time, while more recent memories faded. Their explanation involved an elegant model with deeply counterintuitive implications.



Long-term memory, the Bjorks said, can be characterized by two components, which they named retrieval strength and storage strength. Retrieval strength measures how likely you are to recall something right now, how close it is to the surface of your mind. Storage strength measures how deeply the memory is rooted. Some memories may have high storage strength but low retrieval strength. Take an old address or phone number. Try to think of it; you may feel that it's gone. But a single reminder could be enough to restore it for months or years. Conversely, some memories have high retrieval strength but low storage strength. Perhaps you've recently been told the names of the children of a new acquaintance. At this moment they may be easily accessible, but they are likely to be utterly forgotten in a few days, and a single repetition a month from now won't do much to strengthen them at all.

The Bjorks were not the first psychologists to make this distinction, but they and a series of collaborators used a broad range of experimental data to show how these laws of memory wreak havoc on students and teachers. One of the problems is that the amount of storage strength you gain from practice is inversely correlated with the current retrieval strength. In other words, the harder you have to work to get the right answer, the more the answer is sealed in memory. Precisely those things that seem to signal we're learning well — easy performance on drills, fluency during a lesson, even the subjective feeling that we



know something — are misleading when it comes to predicting whether we will remember it in the future. "The most motivated and innovative teachers, to the extent they take current performance as their guide, are going to do the wrong things," Robert Bjork says. "It's almost sinister."

The most popular learning systems sold today — for instance, foreign language software like Rosetta Stone — cheerfully defy every one of the psychologists' warnings. With its constant feedback and easily accessible clues, Rosetta Stone brilliantly creates a sensation of progress. "Go to Amazon and look at the reviews," says Greg Keim, Rosetta Stone's CTO, when I ask him what evidence he has that people are really remembering what they learn. "That is as objective as you can get in terms of a user's sense of achievement." The sole problem here, from the psychologists' perspective, is that the user's sense of achievement is exactly what we should most distrust.

The battle between lab-tested techniques and conventional pedagogy went on for decades, and it's fair to say that the psychologists lost. All those studies of human memory in the lab — using nonsense syllables, random numbers, pictures, maps, foreign vocabulary, scattered dots — had so little influence on actual practice that eventually their irrelevance provoked a revolt. In the late '70s, Ulric Neisser, the pioneering researcher who coined the term cognitive psychology, launched a broad attack on the approach of Ebbinghaus and his scientific kin.

"We have established firm empirical generalizations, but most of them are so obvious that every 10-year-old knows them anyway," Neisser complained. "We have an intellectually impressive group of theories, but history offers little confidence that they will provide any meaningful insight into natural behavior." Neisser encouraged psychologists to leave their labs and study memory in its natural environment, in the style of ecologists. He didn't doubt that the laboratory theories were correct in their limited way, but he wanted results that had power to change the world.

Many psychologists followed Neisser. But others stuck to their laboratory methods. The spacing effect was one of the proudest lab-derived discoveries, and it was interesting precisely because it was not obvious, even to professional teachers. The same year that Neisser revolted, Robert Bjork, working with Thomas Landauer of Bell Labs, published the results of two experiments involving nearly 700 undergraduate students. Landauer and Bjork were looking for the optimal moment to rehearse something so that it would later be remembered. Their results were impressive: The best time to study something is at the moment you are about to forget it. And yet — as Neisser might have predicted — that insight was useless in the real world. Determining the precise moment of forgetting is essentially impossible in day-to-day life.

Obviously, computers were the answer, and the idea of using them was occasionally suggested, starting in the 1960s. But except for experimental software, nothing was built. The psychologists were interested mainly in theories and models. The teachers were interested in immediate signs of success. The students were cramming to pass their exams. The payoff for genuine progress was somehow too abstract, too delayed, to feed back into the system in a useful way. What was needed was not an academic psychologist but a tinkerer, somebody with a lot of time on his hands, a talent for mathematics, and a strangely literal temperament that made him think he should actually recall the things he learned.

**The day I first meet Wozniak**, we go for a 7-mile walk down a windy beach. I'm in my business clothes and half comatose from jet lag; he's wearing a track suit and comes toward me with a gait so buoyant he seems about to take to the air. He asks me to walk on the side away from the water. "People say that when I get excited I tend to drift in their direction, so it is better that I stand closer to the sea so I don't push you in," he says.

Wozniak takes an almost physical pleasure in reason. He loves to discuss things with people, to get insight into their personalities, and to give them advice — especially in English. One of his most heartfelt wishes is that the world have one language and one currency so this could all be handled more efficiently. He's appalled that Poland is still not in the Eurozone. He's baffled that Americans do not use the metric system. For two years he kept a diary in Esperanto.



Although Esperanto was the ideal expression of his universalist dreams, English is the leading real-world implementation. Though he has never set foot in an English-speaking country, he speaks the language fluently. "Two words that used to give me trouble are *perspicuous* and *perspicacious*," he confessed as we drank beer with raspberry syrup at a tiny beachside restaurant where we were the only customers. "Then I found a mnemonic to enter in SuperMemo: clear/clever. Now I never misuse them."

Wozniak's command of English is the result of a series of heroic experiments, in the tradition of Ebbinghaus. They involved relentless sessions of careful self-analysis, tracked over years. He began with the basic conundrum of too much to study in too little time. His first solution was based on folk wisdom. "It is a common intuition," Wozniak later wrote, "that with successive repetitions, knowledge should gradually become more durable and require less frequent review."

This insight had already been proven by Landauer and Bjork, but Wozniak was unaware of their theory of forgetting or of any of the landmark studies in laboratory research on memory. This ignorance was probably a blessing, because it forced him to rely on pragmatic engineering. In 1985, he divided his database into three equal sets and created schedules for studying each of them. One of the sets he studied every five days, another every 18 days, and the third at expanding intervals, increasing the period between study sessions each time he got the answers right.

This experiment proved that Wozniak's first hunch was too simple. On none of the tests did his recall show significant improvement over the naive methods of study he normally used. But he was not discouraged and continued making ever more elaborate investigations of study intervals, changing the second interval to two days, then four days, then six days, and so on. Then he changed the third interval, then the fourth, and continued to test and measure, measure and test, for nearly a decade. His conviction that forgetting could be tamed by following rules gave him the intellectual fortitude to continue searching for those rules. He doggedly traced a matrix of paths, like a man pacing off steps in a forest where he is lost.

All of his early work was done on paper. In the computer science department at the Poznan University of Technology, "we had a single mainframe of Polish-Russian design, with punch cards," Wozniak recalls. "If you could stand in line long enough to get your cards punched, you could wait a couple of days more for the machine to run your cards, and then at last you got a printout, which was your output."

The personal computer revolution was already pretty far along in the US by the time Wozniak managed to get his hands on an Amstrad PC 1512, imported through quasi-legal means from Hamburg, Germany. With this he was able to make another major advance in SuperMemo — computing the difficulty of any fact or study item and adjusting the unique shape of the predicted forgetting curve for every item and user. A friend of Wozniak's adapted his software to run on Atari machines, and as access to personal computers finally spread among students, so did SuperMemo.

After the collapse of Polish communism, Wozniak and some fellow students formed a company, SuperMemo World. By 1995, their program was one of the most successful applications developed by the country's fledgling software industry, and they were searching for funding that would allow them to relocate to Silicon Valley. That year, at Comdex in Las Vegas, 200,000 people got a look at Sony's new DVD technology, prototypes of flatscreens, and Wozniak's SuperMemo, which became the first Polish product shown at the great geek carnival, then at the height of its influence. In Europe, the old communist experiment in human optimization had run its course. Wozniak believed that in a world of open competition, where individuals are rewarded on merit, a scientific tool that accelerated learning would find customers everywhere.

**Wozniak's chief partner** in the campaign to reprogram the world's approach to learning through SuperMemo was Krzysztof Biedalak, who had been his classmate at the University of Technology. The two men used to run 6 miles to a nearby lake for an icy swim. Biedalak agrees with Wozniak that winter swimming is good for mental health. Biedalak also agrees with Wozniak that SuperMemo produces



extreme learning. But Biedalak does not agree with Wozniak about everything. "I don't apply his whole technique," he says. "In my context, his technique is inapplicable."

What Biedalak means by Wozniak's technique is the extension of algorithmic optimization to all dimensions of life. Biedalak is CEO of SuperMemo World, which sells and licenses Wozniak's invention. Today, SuperMemo World employs just 25 people. The venture capital never came through, and the company never moved to California. About 50,000 copies of SuperMemo were sold in 2006, most for less than \$30. Many more are thought to have been pirated.

Biedalak and I meet and talk in a restaurant in downtown Warsaw where the shelves are covered in gingham and the walls are lined with jars of pickled vegetables. He has an intelligent, somewhat hangdog expression, like a young Walter Matthau, and his tone is as measured as Wozniak's is impulsive. Until I let the information slip, he doesn't even know the exact location of his partner and friend.

"Piotr would never go out to promote the product, wouldn't talk to journalists, very rarely agreed to meet with somebody," Biedalak says. "He was the driving force, but at some point I had to accept that you cannot communicate with him in the way you can with other people."

The problem wasn't shyness but the same intolerance for inefficient expenditure of mental resources that led to the invention of SuperMemo in the first place. By the mid-'90s, with SuperMemo growing more and more popular, Wozniak felt that his ability to rationally control his life was slipping away. "There were 80 phone calls per day to handle. There was no time for learning, no time for programming, no time for sleep," he recalls. In 1994, he disappeared for two weeks, leaving no information about where he was. The next year he was gone for 100 days. Each year, he has increased his time away. He doesn't own a phone. He ignores his email for months at a time. And though he holds a PhD and has published in academic journals, he never attends conferences or scientific meetings.

Instead, Wozniak has ridden SuperMemo into uncharted regions of self-experimentation. In 1999, he started making a detailed record of his hours of sleep, and now he's working to correlate that data with his daily performance on study repetitions. Psychologists have long believed there's a correlation between sleep and memory, but no mathematical law has been discovered. Wozniak has also invented a way to apply his learning system to his intake of unstructured information from books and articles, winnowing written material down to the type of discrete chunks that can be memorized, and then scheduling them for efficient learning. He selects a short section of what he's reading and copies it into the SuperMemo application, which predicts when he'll want to read it again so it sticks in his mind. He cuts and pastes completely unread material into the system, assigning it a priority. SuperMemo shuffles all his potential knowledge into a queue and presents it to him on a study screen when the time is right. Wozniak can look at a graph of what he's got lined up to learn and adjust the priority rankings if his goals change.

These techniques are designed to overcome steep learning curves through automated steps, like stairs on a hill. He calls it incremental reading, and it has come to dominate his intellectual life. Wozniak no longer wastes time worrying that he hasn't gotten to some article he wants to read; once it's loaded into the system, he trusts his algorithm to apportion it to his consciousness at the appropriate time.

The appropriate time, that is, for him. Having turned over his mental life to a computerized system, he refuses to be pushed around by random inputs and requests. Naturally, this can be annoying to people whose messages tend to sift to the bottom. "After four months," Biedalak says sadly, "you sometimes get a reply to some sentence in an email that has been scrambled in his incremental reading process."

For Wozniak, these misfires were less a product of scrambling than of an inevitable clash of goals. A person who understands the exact relationship between learning and time is forced to measure out his hours with a certain care. SuperMemo was like a genie that granted Wozniak a wish: unprecedented power to remember. But the value of what he remembered depended crucially on what he studied, and what he studied depended on his goals, and the selection of his goals rested upon the efficient acquisition of knowledge, in a regressive function that propelled him relentlessly along the path he had chosen. The



guarantee that he would not forget what he learned was both a gift and a demand, requiring him to sacrifice every extraneous thing.

From the business side of SuperMemo, Wozniak's priorities can sometimes look selfish. Janusz Murakowski, one of Wozniak's friends who worked as a manager at the company during its infancy, thinks that Wozniak's focus on his own learning has stunted the development of his invention. "Piotr writes this software for himself," says Murakowski, now a professor of electrical engineering at the University of Delaware. "The interface is just impossible." This is perhaps a bit unfair. SuperMemo comes in eight flavors, some of which were coded by licensees: SuperMemo for Windows, for Palm devices, for several cell phones, even an Internet version. It's true that Wozniak is no Steve Jobs, and his software has none of the viral friendliness of a casual game like *Brain Age* for Nintendo DS. Still, it can hardly be described as the world's most difficult program. After all, photographers can learn to produce the most arcane effects in Photoshop. Why shouldn't more people be able to master SuperMemo?

"It was never a feel-good product," Murakowski says, and here he may be getting closer to the true conflict that lies at the heart of the struggle to optimize intelligence, a conflict that transcends design and touches on some curious facts about human nature. We are used to the idea that normal humans can perform challenging feats of athleticism. We all know someone who has run a marathon or ridden a bike cross-country. But getting significantly smarter — that seems to be different. We associate intelligence with pure talent, and academic learning with educational experiences dating far back in life. To master a difficult language, to become expert in a technical field, to make a scientific contribution in a new area — these seem like rare things. And so they are, but perhaps not for the reason we assume.

The failure of SuperMemo to transform learning uncannily repeats the earlier failures of cognitive psychology to influence teachers and students. Our capacity to learn is amazingly large. But optimal learning demands a kind of rational control over ourselves that does not come easily. Even the basic demand for regularity can be daunting. If you skip a few days, the spacing effect, with its steady march of sealing knowledge in memory, begins to lose its force. Progress limps. When it comes to increasing intelligence, our brain is up to the task and our technology is up to the task. The problem lies in our temperament.

**The Baltic Sea** is dark as an unlit mirror. Wozniak and I walk along the shore, passing the wooden snack stands that won't be open until spring, and he tells me how he manages his life. He's married, and his wife shares his lifestyle. They swim together in winter, and though Polish is their native language, they communicate in English, which she learned with SuperMemo. Wozniak's days are blocked into distinct periods: a creative period, a reading and studying period, an exercise period, an eating period, a resting period, and then a second creative period. He doesn't get up at a regular hour and is passionate against alarm clocks. If excitement over his research leads him to work into the night, he simply shifts to sleeping in the day. When he sits down for a session of incremental reading, he attends to whatever automatically appears on his computer screen, stopping the instant his mind begins to drift or his comprehension falls too low and then moving on to the next item in the queue. SuperMemo graphs a distribution of priorities that he can adjust as he goes. When he encounters a passage that he thinks he'll need to remember, he marks it; then it goes into a pattern of spaced repetition, and the information it contains will stay in his brain indefinitely.

"Once you get the snippets you need," Wozniak says, "your books disappear. They gradually evaporate. They have been translated into knowledge."

As a science fiction fan, I had always assumed that when computers supplemented our intelligence, it would be because we outsourced some of our memory to them. We would ask questions, and our machines would give oracular — or supremely practical — replies. Wozniak has discovered a different route. When he entrusts his mental life to a machine, it is not to throw off the burden of thought but to make his mind more swift. Extreme knowledge is not something for which he programs a computer but for which his computer is programming him.



I've already told Wozniak that I am not optimistic about my ability to tame old reading habits in the name of optimized knowledge. Books, for me, are not merely sources of information I might want to load into memory but also subjective companions, almost substitute people, and I don't see why I would want to hold on to them in fragments. Still, I tell him I would like to give it a shot.

"So you believe in trying things for yourself?" he asks.

"Yes."

This provides his opening. "In that case, let's go swimming."

At the edge of the sea, I become afraid. I'm a strong swimmer, but there's something about standing on the beach in the type of minuscule bathing suit you get at the gift shop of a discount resort in Eastern Europe, and watching people stride past in their down parkas, that smacks of danger.

"I'm already happy with anticipation," Wozniak says.

"Will I have a heart attack?"

"There is less risk than on your drive here," he answers.

I realize he must be correct. Poland has few freeways, and in the rural north, lines of cars jockey behind communist-era farm machinery until they defy the odds and try to pass. There are spectacular wrecks. Wozniak gives close attention to the qualitative estimate of fatal risks. By graphing the acquisition of knowledge in SuperMemo, he has realized that in a single lifetime one can acquire only a few million new items. This is the absolute limit on intellectual achievement defined by death. So he guards his health. He rarely gets in a car. The Germans on the beach are staring at me. I dive in.

Philosopher William James once wrote that mental life is controlled by noticing. Climbing out of the sea and onto the windy beach, my skin purple and my mind in a reverie provoked by shock, I find myself thinking of a checklist Wozniak wrote a few years ago describing how to become a genius. His advice was straightforward yet strangely terrible: You must clarify your goals, gain knowledge through spaced repetition, preserve health, work steadily, minimize stress, refuse interruption, and never resist sleep when tired. This should lead to radically improved intelligence and creativity. The only cost: turning your back on every convention of social life. It is a severe prescription. And yet now, as I grin broadly and wave to the gawkers, it occurs to me that the cold rationality of his approach may be only a surface feature and that, when linked to genuine rewards, even the chilliest of systems can have a certain visceral appeal. By projecting the achievement of extreme memory back along the forgetting curve, by provably linking the distant future — when we will know so much — to the few minutes we devote to studying today, Wozniak has found a way to condition his temperament along with his memory. He is making the future noticeable. He is trying not just to learn many things but to warm the process of learning itself with a draft of utopian ecstasy.

*Contributing editor Gary Wolf ([gary@aether.com](mailto:gary@aether.com)) wrote about futurist Ray Kurzweil in issue 16.04.*

[http://www.wired.com/medtech/health/magazine/16-05/ff\\_wozniak?currentPage=all](http://www.wired.com/medtech/health/magazine/16-05/ff_wozniak?currentPage=all)



## **Rushdie: how the fatwa made me a much nicer man**

### **Author admits he nearly gave up writing during 10 years in isolation – but he emerged stronger and with a new zest for life**

By Jonathan Owen  
Sunday, 4 May 2008

Sir Salman Rushdie has confessed how he emerged a better person after being under a fatwa that saw him live a life in virtual seclusion for almost a decade.

In 1989, Iran's Ayatollah Khomeini issued the author with a death warrant over alleged blasphemy against the Prophet Mohamed in his novel *The Satanic Verses*. In a revelatory encounter with clinical psychologist Pamela Connolly, to be shown on Channel 4 later this month, the author claims the decision ultimately helped him become more self-aware. He recalls how he reached rock bottom when the fatwa was declared and says that it "erased" his personality.

The persecution almost drove him to stop writing altogether, he claims: "It's the only time in my life that I ever really thought, if this is what you get for writing, then why do it?"

Speaking during a session with Dr Connolly for the *Shrink Rap* series, which has seen celebrities submit to what amounts to a televised therapy session, Rushdie admits he was "deranged" when claiming to be a Muslim in an attempt to deal with the pressures of the fatwa and "that's the moment at which I hit bottom".

He adds: "After that, it cleared things up in my head... I stopped being the prisoner of that thing, because I thought, OK, there are people who are not going to like me and do you know what? I don't like them."

The author also reveals how he suffered during his time at Rugby public school. In a scathing aside, he says, "I was clever, and I was foreign, and I was bad at games, and these are the three mistakes at an English boarding school."

Everyone now knows his views on marriage. In an interview with the writer Kathy Lette for *Elle* magazine, Rushdie proclaimed: "I've been married four times, but I actually don't think marriage is necessary. Girls like it – it's the dress."

He seems to be enjoying being single since his divorce from Indian actress Padma Lakshmi. This week he was seen nuzzling actress Scarlett Johansson in the video for her debut single. He was photographed 10 days ago at the White House Correspondents' Association dinner in Washington DC on the arm of statuesque brunette actress Olivia Wilde, 24.

<http://www.independent.co.uk/arts-entertainment/books/news/rushdie-how-the-fatwa-made-me-a-much-nicer-man-820863.html>

**Faber launches print-on-demand classics****Guy Dammann****Friday May 2, 2008****guardian.co.uk**

Could out-of-print books be a phenomenon of the past? That's the question that will be facing publishers, agents and authors after the launch on June 2 of a new imprint from Faber and Faber designed to make available a large number of titles which until now have been out of print.

The new imprint, called Faber Finds, will publish such classic titles as Angus Wilson's *Anglo Saxon Attitudes* and John Betjeman's *Ghastly Good Taste*, as well as relatively recent titles such as John Carey's acclaimed biography of John Donne. Faber Finds will make use of print-on-demand technology in order to allow for print runs of between one and 50 books at a time, thereby avoiding the financial risks associated with traditional publishing's requirement for large-volume print runs.

The new titles, which will retail at about £9, and be printed with automatically generated cover designs, will not be stocked in large quantities by booksellers, but will be available to order through most major booksellers and the majority of internet-based book retailers.

The publisher aims to publish up to 20 new titles every month, after the launch list of 100 books to be made available this June. Faber is the first mainstream non-academic publisher to invest heavily in the POD model, and actively to source material previously published elsewhere for a POD imprint.

Joel Rickett, deputy editor of the *Bookseller*, suggested that the industry's attention will be fixed on whether Faber will be able to "generate demand for the new titles ... with almost no presence in the bookshops".

The move follows recent announcements by the Peters Fraser & Dunlop agency of a plan to link up with Lightning Source, one of the largest POD output facilities. The agency, which specialises in representing the holders of dormant rights of out-of-print authors and literary estates, has targeted the initiative at writers who wish to see their out-of-print titles re-listed with internet book retailers such as Amazon.

Angela Huth and the estates of VS Pritchett and Storm Jameson have already signed up to the initiative, which bypasses traditional publishers and offers copyright holders 10% royalties. But the announcement met with criticism from the Society of Authors, who complained that Peters, Fraser & Dunlop was effectively taking 90% of the profits on the project in return for very little actual work.

Print-on-demand technology, which when first announced was presented as something of a potential godsend to traditional publishers struggling to balance the costs of large print runs with a changing, more top-heavy market, has hitherto been largely ignored by mainstream publishers on the grounds that the cost of printing of individual books ranged between 10 to 30 times greater than a traditional paperback reprint.

However, for lower distribution academic presses, and self-publishing imprints, the benefits of a technology designed to remove almost all risk from the decision to publish lower profile titles has been welcomed with open arms. Self-publishing firms such as Lulu and the PublishAmerica have risen from being small concerns to being major industry players with very considerable revenues.

Lulu, whose revenues have doubled every year since it was set up by entrepreneur Bob Young 5 years ago, claims to publish 4,000 titles a week, adding to a catalogue of now well over 200,000 books. Although concrete revenue figures for such companies are difficult to obtain, a recent report by the Book Industry Study Group estimated that combined sales by smaller publishers and self-publishing companies could have been as high as \$14.2bn (£7.3bn) in 2005, the last year in which statistics were available.



If Faber finds commercial success many other houses are sure to follow suit, a move which could spell the end of the out-of-print book.

Many in the industry have been surprised by the huge recent internet-enabled growth of niche markets for second-hand and self-published books, and may decide that investing in the market for out-of-print books could be a shrewd response.

The growing market for POD titles in the US also ran into controversy last month when Amazon.com announced that publishers and authors wishing to list print-on-demand titles with them would have to use Amazon's in-house service, a subsidiary company called BookSurge which the internet retailer acquired in 2005.

Amazon was accused of effectively denying small POD publishers an outlet, putting a burgeoning and diverse market in danger. Many small publishers, who use the main alternative to BookSurge, Lightning Source, have now moved to boycott Amazon.com, including the Arts Council England sponsored new writing initiative, YouWriteOn.com.

The online giant has vigorously denied the claims, arguing in a statement that the measures were simply designed to reduce costs and environmental impact.

"[W]e can provide a better, more timely customer experience if the POD titles are printed inside our own fulfilment centres," the company stated. "In addition, printing these titles in our own fulfilment centres saves transportation costs and transportation fuel."

The newly announced Faber Finds imprint is set to receive vigorous endorsements from prominent authors such as AS Byatt, Michael Frayn, and Julian Barnes as part of a cover story on the new imprint in tomorrow's Guardian Review.

<http://books.guardian.co.uk/news/articles/0,,2277671,00.html?gusrc=rss&feed=10>

### *Gone in an Instant*

#### **Top photographers are angry over Polaroid's fade to black.**

- Published May 4, 2008



Robert Mapplethorpe, *Untitled*, 1973

(Photo: courtesy of the Whitney with permission from the Robert Mapplethorpe Foundation )

It wasn't supposed to be this way, but "Polaroids: Mapplethorpe," opening this week at the Whitney, has become a memorial to the medium. Several weeks ago, the diminished Polaroid Corporation announced it will, in 2009, quit the instant-film business. Of course, it's hard to argue with the ease of digital for the lion's share of see-it-now picture-taking. Nevertheless, a lot of photographers are vehement about what they're losing. "It's the worst disaster since Hiroshima," shouts Timothy Greenfield-Sanders, who shoots large-format Polaroid Type 809. "I just bought \$5,000 worth—I've got it in my basement. I never shot color till the mid-eighties, when I started to work with Polaroid. It was such a beautiful film—lush color, very forgiving for skin. It was always something artists liked." Chuck Close, who uses Polaroid's 20-by-24-inch studio camera, loved the black-and-white tones: "It's loaded with silver. Actually, there used to be even more, in the old films that you had to coat. It was beautiful. It's not replaceable, and they're leaving it like roadkill. These corporate raiders who buy a company and strip it for everything profitable—they just pick the bones." Mapplethorpe's work at the Whitney is from the early seventies, when he was learning how to take pictures, and "its instant nature was incredibly important," says show curator Sylvia Wolf. "You can see that he was learning how to expose, how to compose. He said he was too impatient to wait for a lab." It's also evident that he was working in the moment. Over and over, he photographed Patti Smith, his roommate at the Hotel Chelsea. "There's a sexiness and titillation to the instant process," says Wolf. It's intimate. "Now what the hell am I supposed to do?" asks John Waters, who's shot a Polaroid of each person who's come into his apartment since 1992—friends, interviewers, deliverymen, everyone. "Digital isn't instant gratification, and those cameras don't make that sexy sound." Waters, too, is hoarding film. "What are wardrobe departments supposed to do?" he continues. "How else will they keep costume continuity shots? And has anybody thought about the poor home-porno enthusiasts? Are they supposed to now risk arrest by taking some memory disk to the drugstore to get printed? The world is a terrible place without Polaroid."

<http://nymag.com/news/intelligencer/46655/>



*The photo is dead. Long live the photo*

KATE TAYLOR

From Saturday's Globe and Mail

May 2, 2008 at 9:33 PM EDT



Toronto artist Robert Burley is currently documenting the fate of chemical photography, recording the abandonment and demolition of various Kodak plants. The films, papers and processing chemicals these factories produced will soon be obsolete, although Burley himself is still physically printing images from negatives, albeit ones he edits digitally. The most notable of Burley's large, highly detailed colour photographs shows the implosion of buildings 65 and 69 at Kodak Park in Rochester, N.Y., where a crowd that includes people who worked in the plant busily snap pictures of its demise on their digital cameras. Whatever sacrifices it may demand, technology is irresistible.

A giant mural of this hugely ironic image – created thanks to digital technology, of course – now greets anyone who enters the courtyard of Toronto's Museum of Contemporary Canadian Art on Queen Street West. It is there for Contact, the month-long, city-wide photography festival that launched this week, and it serves as an introduction to the issues MOCCA is raising in an international group show entitled *Between Memory and History: From the Epic to the Everyday*. Photography, the family historian, court painter, official scribe and crusading journalist of the 20th century, has penetrated the 21st century in ways that Kodak founder George Eastman himself could hardly have dreamed. In MOCCA's second year providing a focal point for Contact (now the largest photography festival in the world), curators Bonnie Rubenstein and David Liss address this year's festival theme of memory and history, provocatively asking where exactly photography is leading us, cellphones and Coolpix in hand.

The answer provided by the German artist Thomas Ruff is a dark one. He is represented by three huge, heavily pixelated images of familiar scenes identified only by such uninformative titles as *JPEG BD01*. One is a massive skyscraper in some sprawling new city – Dubai, perhaps? Another is an iceberg, melting too precipitously, one would guess. A third is a building in some Middle Eastern city, collapsing, violently, one assumes. These photos, which Ruff lifts from the Internet before he exaggerates their disintegration into pixels on the one hand and enlarges to the size of monumental history painting on the other, speak directly to the false relationship that the ubiquitous image can create between the viewer and actual experience.



On a lighter note, the British photographer Martin Parr also investigates the effect of photography's banality on lived experience in an amusing but increasingly misanthropic series featuring various camera-toting tourists pictured everywhere from the pyramids at Giza to Las Vegas, where they have their picture taken by a fake gondolier in front of a fake Venice.

In direct contrast to these approaches, demanding we see rather than pointing out that we don't, the French photographer Luc Delahaye positions himself as something of a super-journalist, recording in penetrating detail the whole scene. He is represented here by a photograph of the Jenin refugee camp on the West Bank shortly after the Israeli attacks of 2002. The photo records the rubble of concrete and steel with both impressive sweep and minute detail. In an age highly skeptical of journalistic objectivity, perhaps it is a picture that will inevitably be read as an indictment of Israel, but in truth it shows nothing of the motivations and little of the suffering on either side of the dispute. The people in the photograph, seen from a great distance, are not tearing their hair nor weeping, but rather walking, rather like tourists themselves, through the ruins of their city. In recalling the grand painting of centuries past, the image points to the mercilessness of history itself, rather like Brueghel's famed image of a tiny Icarus falling from the sky as an oblivious peasant below goes about his plowing.

Has photography then completely supplanted painting in the role of historical and political record? In much more emotionally directive work, the Israeli photographer Adi Nes answers with a resounding yes, posing friends and neighbours in the guise of famous figures from art. With *Hagar*, he mimics Dorothea Lange's famed image of a migrant mother in the Depression, perfectly reproducing the original's notion of nobility in suffering. If that exercise seems a trifle artificial, with *Abraham and Isaac*, the image of a

homeless man pushing a young boy in a shopping cart, Nes achieves something more moving: making their plight seem real and important by imbuing it with the grandeur of art.



These images speak to great events and communal experiences, but at the other end of the spectrum photography not only makes the far-flung instantly accessible, it also makes the intensely private instantly recordable. Perhaps, as we all erect our personal webcams, the future of photography lies much more in the direction that the American artist Nan Goldin has pioneered with her impromptu portraits of herself and her friends. The MOCCA exhibit includes *Heartbeat*, a 14-minute slide show of various couples, mostly straight, one gay, some with children, often naked, in bathtubs, smoking cigarettes, nursing a baby, travelling by train, swimming and making love.

Goldin's work, shot in available light with the awareness but apparently not the self-consciousness of her subjects, is often heart-stoppingly intimate. (Not all of these people seem happy, but all of them appear to be happily in love.) And yet, the presence of the camera inevitably raises the possibility that the subjects are not generously giving of themselves, but rather posing for it in some artistic version of the scientific principle whereby the observer's presence necessarily changes what is being observed.

That is the question that the Brazilian-American photographer Alessandra Sanguinetti addresses so directly and so hauntingly in her series *The Adventures of Guille and Belinda and the Enigmatic Meaning of their Dreams*. Her subjects are two prepubescent girls, creatures plunging headlong into the age of self-definition who seem both joyfully lacking in self-consciousness and delighted to try on roles for both themselves and the photographer. The photographs offer moments as staged as a nativity scene on the one hand and as impromptu as a morning on the porch on the other. Their arresting images are made all the more compelling because the apparently inseparable girls are so physically mismatched. (One is very slight; the other is quite fat.)

The artist whose work might serve to summarize all these directions is the Dutch photographer Bert Teunissen, who has shot a series of large-scale colour images of mainly elderly Europeans posed in their even older houses. The odd bit of jerry-rigged wiring points to their vintage; these are places that predate electricity and the images represent ways of life that will vanish in the face of increasing European homogeneity. These dramatically shadowed pictures recall the chiaroscuro of the Dutch masters and thus

elevate their subjects in the same way as Nes's *Abraham and Isaac*. They are filled with a sense of loss and regret for something that is passing, and yet also some awareness that these are not comfortable places nor easy lives.

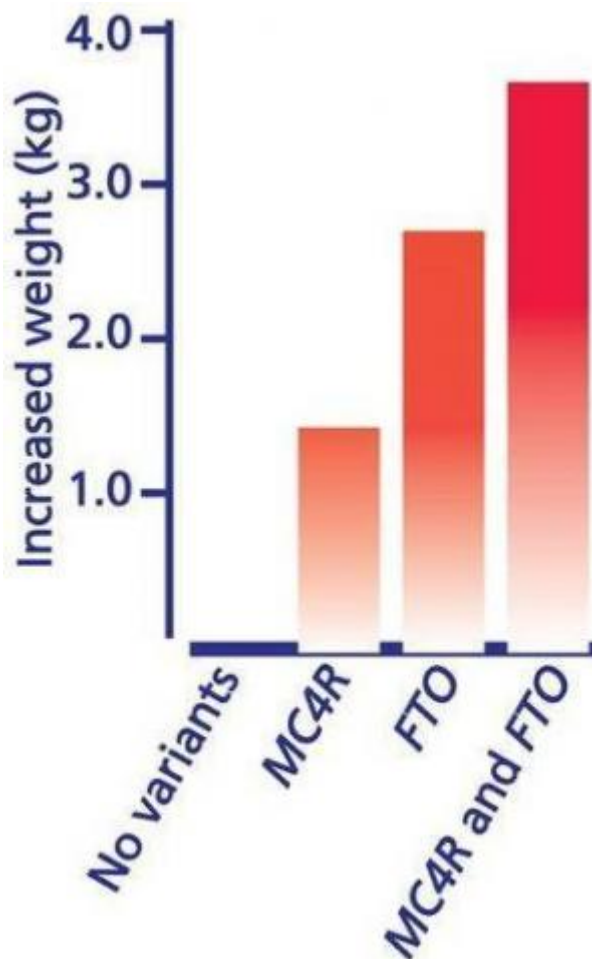


Domestic electricity and popular photography both became widespread at the beginning of the 20th century, yet it is 21st-century digital technology that allows Teunissen to easily enlarge his photos to the scale of the Old Masters. Like Burley's Kodak workers recording their loss with the very technology that has caused it, Teunissen relies on modernity to lament the disappearance of the pre-modern. As the digital image and its eager viewer waltz blindly towards the future, these photographers cut in, determined that art can still lead the dance.

*The Contact photography festival continues at various venues in Toronto until May 31*  
([www.contactphoto.com/](http://www.contactphoto.com/) or 416-539-9595 ).

<http://www.theglobeandmail.com/servlet/story/RTGAM.20080502.contact03/BNStory/Entertainment/?page=rss&id=RTGAM.20080502.contact03>

## New DNA Variants Found That Can Help To Pile On The Pounds



*Approximate influence on adult weight (increased weight over average, in kg) for an adult carrying two copies of both the MC4R and the FTO predisposing variants. (Credit: Image courtesy of Wellcome Trust Sanger Institute)*

ScienceDaily (May 5, 2008) — A study of 90,000 people has uncovered new genetic variants that influence fat mass, weight and risk of obesity. The variants act in addition to the recently described variants of the FTO gene: adults carrying variants in both genes are, on average, 3.8 kg (or 8.5 lb) heavier.

The variants map close to a gene called MC4R: mutations in this gene are the most common genetic cause of severe familial obesity. The study highlights the power of large collections of volunteer samples to uncover common variants that influence health.

"By working together with many international groups we have been able to assemble a sample collection which was large enough to allow this finding to be made," explains Dr Ruth Loos, leading author from the Medical Research Council Epidemiology Unit. "Several groups had shown that rare, highly disruptive variants in the MC4R gene were responsible for very severe, genetic forms of obesity: this collaboration has uncovered more common variants that affect more people."

The study, published in *Nature Genetics*, is led by investigators from the Cambridge GEM consortium (Genetics of Energy Metabolism) and Oxford University and is a collaboration between 77 institutions from the UK, USA, France, Germany, Italy, Finland and Sweden.



The team studied more than 77,000 adults and found that two copies of genetic variants resulted in an average increase in weight of about 1.5 kg.

This is the second set of common variants that are associated with weight and obesity, following the study, involving many of the same team, published in April 2007 that uncovered a role for the FTO gene. People who carry two copies of an FTO variant are about 2-3 kg heavier than those who have no copies of the variant. Importantly, the effects of the new gene add to those of FTO; people who carried both the FTO variant and new variants were on average 3.8 kg (8.5 lb) heavier.

"This is a great example of how cooperation can bring about new findings that can be missed when researchers work in isolation," explains Dr Inês Barroso, Investigator at the Wellcome Trust Sanger Institute and one of the senior authors on the study. "The precise role in obesity of genetic variants in FTO and near MC4R remains to be discovered, but we can now begin to understand the biological consequences of these variants. This is where this research will make a difference."

MC4R protein plays a pivotal role in many aspects of physiology, including regulation of appetite and energy expenditure. The severe form of MC4R-related obesity is a consequence of alterations in the gene sequence, resulting in an inactive or less active MC4R protein. By contrast, the new variants lie some distance from the MC4R gene. The team suspect that the sequence variant changes activity of the MC4R gene, perhaps by disrupting DNA regions required for normal activity of MC4R.

"Through this new and powerful genetic approach we are increasingly finding that the genes known to play a role in severe - but rare - diseases are also implicated in much more common disease," explains Professor Mark McCarthy, Robert Turner Professor of Diabetes at the University of Oxford, UK. "The common variants we are uncovering do not have such a dramatic effect on the normal functioning of the gene as do the rare mutations in MC4R that can cause rare examples of very serious, early onset obesity."

Dramatically, in a study of almost 6000 children, they found that the effects were almost double those seen in adults. Between the ages of four and seven, this additional increase in weight was the result, almost exclusively, of gain of fat tissue, and not due to gain in muscle or other solid tissues.

This more dramatic effect in young children reflects the more extreme consequences seen with rare variants of MC4R that severely disrupt its activity, suggesting that the novel variants do indeed exert their effect through action on MC4R. "Our work to understand common disease, such as obesity, depends on the participation of thousands of people - members of the public who provide samples," explains Professor Nick Wareham, Director of the MRC Epidemiology Unit. "Without their willing participation, we could never achieve the power in our research to make striking findings like this."

"For each discovery, our efforts and the contribution of the participants will lead to improved healthcare for the population at large." The team will now look to uncover how the DNA variants affect activity of the MC4R protein, which is a key player in orchestrating information from the body to control appetite and energy expenditure to keep body weight in balance. The team propose that altered activity of MC4R, imposed by the variants, might reduce its ability to carry out this important role. The team emphasize that, although gene variants can affect weight, body mass index and obesity, they are only part of the story: lifestyle actions such as good diet and regular exercise are vital to control of weight.

Reference: Loos RJF et al. (2008). Association studies involving over 90,000 people demonstrate that common variants near to MC4R influence fat mass, weight and risk of obesity. *Nature Genetics* Published online on Sunday 4 May 2008. doi: 10.1038/ng.140.

*Adapted from materials provided by Wellcome Trust Sanger Institute.*

<http://www.sciencedaily.com/releases/2008/05/080504153814.htm>

## Rare Textiles From Honduras Ruins Suggests Mayans Produced Fine Fabrics



*Textiles conservator Margaret Ordoñez. (Credit: URI Department of Communications & Marketing photo by Michael Salerno Photography)*

ScienceDaily (May 5, 2008) — Very few textiles from the Mayan culture have survived, so the treasure trove of fabrics excavated from a tomb at the Copán ruins in Honduras since the 1990s has generated considerable excitement.

Textiles conservator Margaret Ordoñez, a professor at the University of Rhode Island, spent a month at the site in 2004 examining 100 textile samples found in a tomb, and since then she has been analyzing tiny fragments of 49 samples she brought back to her lab to see what she could learn from them.

The tomb, one of three excavated by archaeologists from the University of Pennsylvania, was of a woman of high status who was buried during the 5th century.

“What was most amazing was that there were as many as 25 layers of fabrics on an offertory platform and covering pottery in the tomb, and they all had a different fabric structure, color, and yarn size, so it’s likely that the tomb was reopened – perhaps several times -- and additional layers of textiles were laid there years after her death,” said Ordoñez.

One fabric in particular had an especially high thread count – 100 yarns per inch – which Ordoñez said is even considered high for modern textiles. “It speaks to the technology they had at the time for making very fine fabrics. It’s gratifying that we’ve been able to document that the Mayans were quite skillful at spinning and weaving.”



Analyzing these ancient textile samples is a complex and laborious process, particularly because the remnant samples are so small.

Ordoñez pulled out about 30 plastic containers the size of a film canister, and inside each was what looked like a rock or bit of compressed mud about an inch in diameter. Within each piece were flecks of what only an expert could tell are tiny fragments of fabric.

“Sometimes you really have to use your imagination to tell that there’s a textile in there,” she said.

Handling each piece very carefully so it doesn’t crumble, Ordoñez uses a stereomicroscope to examine the yarn structure, the fabric structure, and the finish on each sample. She then brings the sample to the URI Sensors and Surface Technology Laboratory to use a scanning electron microscope to look in more fine detail at the plant material from which each piece of yarn was made.

“I can look at the cell structure of the yarn and compare it to reference materials to identify the kind of plant each thread is made from,” explained Ordoñez, who may spend as many as three days examining each fragment. “We’ve found threads made from cotton, sedge grasses, and all kinds of other plant fibers.”

After completing the analysis of the textile samples in her lab this summer, the URI professor plans to return to the Copán ruins in 2009 to examine more fragments from the woman’s tomb and other sites. She said the working conditions at the site are challenging and the research facilities are primitive, but the site provides the best opportunity to learn more about the Mayan culture.

She may even do a study of Mayan statuary at the site to see what she can learn from the way that sculptors represented textiles from the period.

URI Department of Communications & Marketing photo by Michael Salerno Photography.

*Adapted from materials provided by University of Rhode Island.*

<http://www.sciencedaily.com:80/releases/2008/04/080430173528.htm>





## Lasers And Milk: The Common Denominator

ScienceDaily (May 5, 2008) — Reading about a "random laser" for the first time, you might wonder whether this term refers to the laser in your CD player which plays the song titles in the random shuffle mode. In physics, however, "random lasers" refer to a class of microlasers which use the principle of random light scattering as an integral part of the laser operation.

In conventional lasers light is trapped between two highly reflecting mirrors where it is amplified by pumping from outside. Only when this amplification process is efficient enough, the laser begins to operate. After the initiation of the modern study of random lasers by Nabil M. Lawandy (Brown University), it was demonstrated by Hui Cao (Northwestern/Yale) and coworkers that you don't necessarily require elaborate mirrors to confine light long enough for lasing from micron sized devices.

All you need to do is to put light into a highly disordered medium where scattering in random directions takes place. This mechanism, similar to the multiple scattering of light which makes a glass of milk look white, can prevent the light from escaping too quickly. If the random medium is optically active, pumping it with energy from outside will result in the emission of coherent light at sharply defined frequencies and in random directions.

"In practice, random lasers are small beads of micrometer size, too small to be seen by the human eye", says Hakan E. Türeci, a research associate in the Quantum Photonics Group at ETH Zurich, who coauthored the article with Li Ge, Stefan Rotter and A. Douglas Stone at Yale University. "Due to their robustness and ease of manufacture, these lasers are sometimes referred to as "laser paint" and have found various applications, currently commercially available, such as document security and remote sensing. There are envisioned application areas in diagnostic imaging and super-fast displays as well".

### Laser theory extended

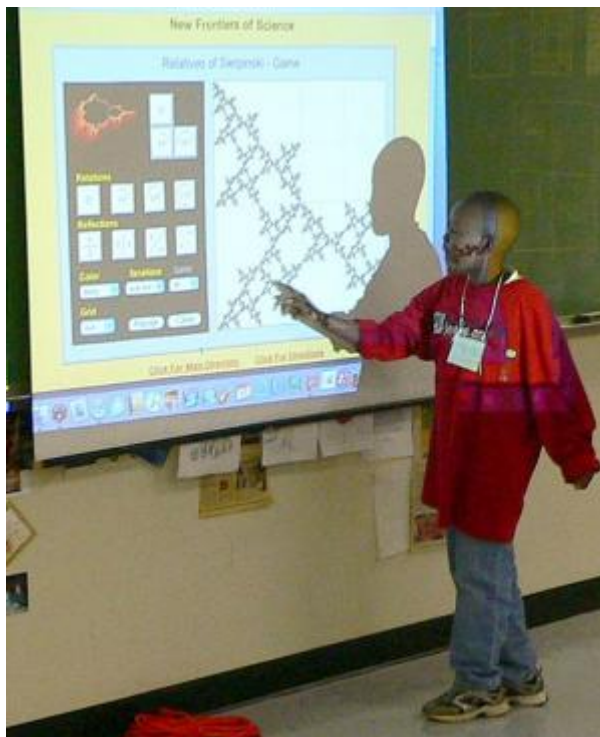
Conventional laser theory tries to describe the operation of a laser by looking at the resonances of the laser cavity. In a random laser these resonances are, due to the lack of any defining mirrors, however, not at all well defined. The resonances are so closely spaced that they cannot be looked at independently of each other. Türeci and co-workers at Yale University have now extended the conventional laser theory such that it can be applied to random lasers, one of the most exotic type of lasers in existence, as well. In recent experiments it was observed that a specific random laser always shines at the same frequencies, but at intensities which differ strongly from measurement to measurement. With their publication in Science the authors show that this result can be traced back to unusually strong interactions between the laser modes.

Türeci said, "Future research in designing novel micro and nanolasers will benefit from our approach, and we are implementing some of these ideas already with experimental collaborators to improve, e.g. power output, directional emission, for different kinds of microlasers."

*Adapted from materials provided by [ETH Zurich](#), via [AlphaGalileo](#).*

<http://www.sciencedaily.com:80/releases/2008/05/080502110829.htm>

## Closing The Achievement Gap In Math And Science



*A middle-school student describes a mathematical image at the MSP Summer Institute for middle school math teachers in Broward County, Fla. (Credit: Richard Voss, Heinz-Otto Peitgen)*

ScienceDaily (May 5, 2008) — The latest results from the National Science Foundation's (NSF) Math and Science Partnership (MSP) program show not only improved proficiency among all elementary and middle school students, but also a closing of the achievement gaps between both African-American and Hispanic students and white students in elementary school math, and between African-American and white students in elementary and middle-school science.

Since 2002, the MSP program has supported institutions of higher education and K-12 school systems in partnering higher education faculty from science, technology, engineering and math (STEM) disciplines with K-12 teachers. Through the program, STEM faculty provide professional development and mentoring to math and science teachers to deepen their content knowledge in their field of expertise--all with the goal of better preparing students in these subjects.

The MSP program currently supports 52 such partnerships around the country that unite some 150 institutions of higher education with more than 700 school districts, including more than 5,200 schools in 30 states and Puerto Rico. More than 70 businesses, numerous state departments of education, science museums and community organizations are also partners.

The current results are drawn from schools whose MSP projects target specific improvements in their math and/or science programs. The data used are student scores on state proficiency tests in math and science collected over three different school years. The figure at right shows how student subgroups within MSP projects focused on math improvements performed on math tests in the 2003-2004 and 2005-2006 school years, respectively.

Among approximately 39,000 students at 160 schools, the scores of white students performing at or above the proficient level rose 4.6 percentage points between the 2003-2004 and the 2005-2006 school years. Meanwhile, the results for Hispanic and African-American students went a long way towards closing an



identified achievement gap. The percentage of Hispanic students performing at or above proficient rose by 18.3 percentage points--from 35.9 to 54.2 percent--and those of African-American students rose by 17.9 points--from 27.6 to 45.5 percent. Although small in number, Asian-American students, special education students, and students with limited English proficiency also showed gains.

The rise in science scores among elementary students within MSP projects focused on science improvements was not quite as pronounced, as shown in the figure at right, with the percentage of Hispanic students scoring at or above proficient rising by 6.5 percentage points, those of African-American students by 15.8, and those of white students by 12.2. Science testing is not mandated in all states, and there was a smaller universe of schools--96 schools, with assessments for only 7,500 students--reporting science proficiency results. However, science testing promises to be an area of increasing focus in the states, because the No Child Left Behind act requires that all states implement science testing by 2009.

Similar analyses were conducted for MSP middle schools. Math scores were drawn from 151 schools within MSP projects focused on math improvements and representing about 95,000 students while science scores were drawn from 51 schools within MSP projects focused on science improvements and representing about 9,500 students. While both math and science scores went up in all subgroups, results were the most pronounced among African-American science students; the percentage of students performing at or above proficient rose from 15.9 percent to 23.5 percent over the period, and this closed the achievement gap with white students.

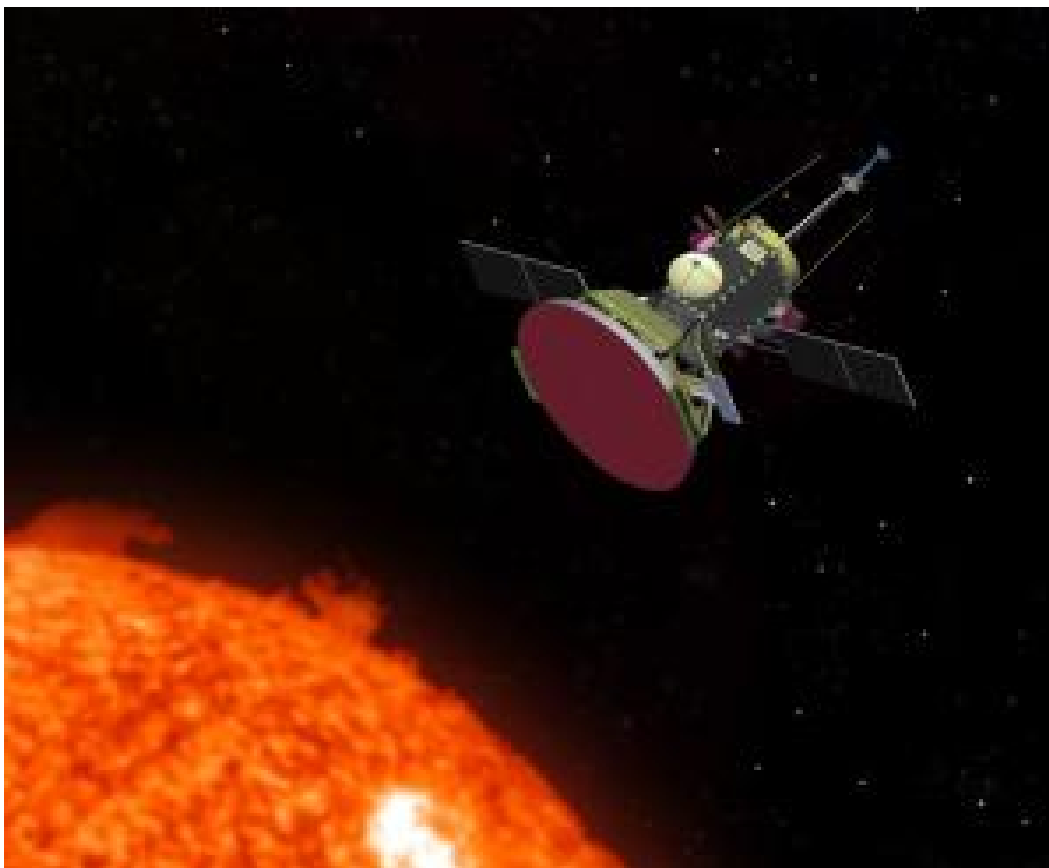
"I'm happy to see that schools' involvement in MSP projects is continuing to have a positive impact on student proficiency results," says NSF program director Dan Maki. "We're particularly excited about the progress being made among Hispanic and African-American students, as closing achievement gaps--while improving achievement for all students--has been a goal of the MSP program since its inception. We continue to monitor data for participating high schools, but we aren't seeing trends yet."

Currently, MSP projects are actively engaged in determining which strategies most strongly correlate to improved student performance. For example, the Milwaukee Mathematics Partnership, led by the University of Wisconsin-Milwaukee, has a major objective of developing district- and school-based teacher leaders and distributing their expertise across Milwaukee's schools. The project has studied how often the teacher leaders effectively spend time with other teachers and strongly connect with networks of teachers, and found that schools in which teacher leaders play important roles demonstrate stronger student achievement results in mathematics.

*Adapted from materials provided by National Science Foundation.*

<http://www.sciencedaily.com:80/releases/2008/05/080502094232.htm>

## Plan To Send A Probe To The Sun



*Artist's concept of NASA's Solar Probe spacecraft making its daring pass toward the sun, where it will study the forces that create solar wind. The Johns Hopkins University Applied Physics Laboratory in Laurel, Md., will design and build the spacecraft, on a schedule to launch in 2015. Preliminary designs include a 9-foot-diameter, 6-inch-thick, carbon-foam-filled solar shield atop the spacecraft body, and two sets of solar arrays that would retract or extend as the spacecraft swings toward or away from the sun -- making sure the panels stay at proper temperatures and power levels. (Credit: NASA/Johns Hopkins University Applied Physics Laboratory)*

ScienceDaily (May 4, 2008) — The Johns Hopkins University Applied Physics Laboratory is sending a spacecraft closer to the sun than any probe has ever gone – and what it finds could revolutionize what we know about our star and the solar wind that influences everything in our solar system.

NASA has tapped APL to develop the ambitious Solar Probe mission, which will study the streams of charged particles the sun hurls into space from a vantage point within the sun's corona – its outer atmosphere – where the processes that heat the corona and produce solar wind occur. At closest approach Solar Probe would zip past the sun at 125 miles per second, protected by a carbon-composite heat shield that must withstand up to 2,600 degrees Fahrenheit and survive blasts of radiation and energized dust at levels not experienced by any previous spacecraft.

Experts in the U.S. and abroad have grappled with this mission concept for more than 30 years, running into seemingly insurmountable technology and budgetary limitations. But in February an APL-led team completed a Solar Probe engineering and mission design study at NASA's request, detailing just how the robotic mission could be accomplished. The study team used an APL-led 2005 study as its baseline, but then significantly altered the concept to meet challenging cost and technical conditions provided by NASA.



“We knew we were on the right track,” says Andrew Dantzer, Solar Probe project manager at APL. “Now we’ve put it all together in an innovative package; the technology is within reach, the concept is feasible and the entire mission can be done for less than \$750 million [in fiscal 2007 dollars], or about the cost of a medium-class planetary mission. NASA decided it was time.”

APL will design and build the spacecraft, on a schedule to launch in 2015. The compact, solar-powered probe would weigh about 1,000 pounds; preliminary designs include a 9-foot-diameter, 6-inch-thick, carbon-foam-filled solar shield atop the spacecraft body. Two sets of solar arrays would retract or extend as the spacecraft swings toward or away from the sun during several loops around the inner solar system, making sure the panels stay at proper temperatures and power levels. At its closest passes the spacecraft must survive solar intensity more than 500 times what spacecraft experience while orbiting Earth.

Solar Probe will use seven Venus flybys over nearly seven years to gradually shrink its orbit around the sun, coming as close as 4.1 million miles (6.6 million kilometers) to the sun, well within the orbit of Mercury and about eight times closer than any spacecraft has come before.

Solar Probe will employ a combination of in-place and remote measurements to achieve the mission’s primary scientific goals: determine the structure and dynamics of the magnetic fields at the sources of solar wind; trace the flow of energy that heats the corona and accelerates the solar wind; determine what mechanisms accelerate and transport energetic particles; and explore dusty plasma near the sun and its influence on solar wind and energetic particle formation. Details will be spelled out in a Solar Probe Science and Technology Definition Team study that NASA will release later this year. NASA will also release a separate Announcement of Opportunity for the spacecraft’s science payload.

“Solar Probe is a true mission of exploration,” says Dr. Robert Decker, Solar Probe project scientist at APL. “For example, the spacecraft will go close enough to the sun to watch the solar wind speed up from subsonic to supersonic, and it will fly through the birthplace of the highest energy solar particles. And, as with all missions of discovery, Solar Probe is likely to raise more questions than it answers.”

APL’s experience in developing spacecraft to study the sun-Earth relationship – or to work near the sun – includes ACE, which recently marked its 10th year of sampling energetic particles between Earth and the sun; TIMED, currently examining solar effects on Earth’s upper atmosphere; the twin STEREO probes, which have snapped the first 3-D images of explosive solar events called coronal mass ejections; and the Radiation Belt Storm Probes, which will examine the regions of energetic particles trapped by Earth’s magnetic field.

Solar Probe will be fortified with heat-resistant technologies developed for APL’s MESSENGER spacecraft, which completed its first flyby of Mercury in January and will begin orbiting that planet in 2011. Solar Probe’s solar shield concept was partially influenced by designs of MESSENGER’s sunshade.

*Adapted from materials provided by Johns Hopkins University.*

<http://www.sciencedaily.com:80/releases/2008/05/080502094224.htm>

## Did Dust Storms Make 1930s Dust Bowl Drought Worse?



*Goodwell, Oklahoma, June 4, 1937. (Credit: Image courtesy of The Earth Institute at Columbia University)*

ScienceDaily (May 4, 2008) — The Dust Bowl drought of the 1930s was one of the worst environmental disasters of the Twentieth Century anywhere in the world. Three million people left their farms on the Great Plains during the drought and half a million migrated to other states, almost all to the West. But the Dust Bowl drought was not meteorologically extreme by the standards of the Nineteenth and Twentieth Centuries. Indeed the 1856-65 drought may have involved a more severe drop in precipitation. It was the combination of drought and poor land use practice that created the environmental disaster.

Much of the Plains had been plowed up in the decades before the 1930s as wheat cropping expanded west. Alas, while natural prairie grasses can survive a drought the wheat that was planted could not and, when the precipitation fell, it shriveled and died exposing bare earth to the winds. This was the ultimate cause of the wind erosion and terrible dust storms that hit the Plains in the 1930s. There had never been dust storms like these in prior droughts. In the worst years of the 1930s on as many as a quarter of the days dust reduced visibility to less than a mile. More soil was lost by wind erosion than the Mississippi carried to the sea. Although the numbers are not known, hundreds if not thousands of Plains residents died from 'dust pneumonia', a euphemism for clogging of the lungs with dirt.

But did the dust storms have a meteorological impact? There are two good reasons to ask this question. First we know from studies elsewhere in the world (e.g. the Sahel) that dust can impact circulation and precipitation. Second the Dust Bowl drought was unique in its spatial pattern - further north than is typical for a La Nina forced, or La Nina plus warm subtropical North Atlantic forced, drought. See our page "Was the Dust Bowl Predictable?". Did the dust storms impact either the intensity of the drought or its area of impact?

We have addressed this using the Goddard Institute for Space Studies atmosphere GCM which contains a dust module that can lift up dust from the surface, transport it in the atmosphere and allow it to interact with solar and longwave radiation transfer in the atmosphere. See the GISS Science Brief, "Desert Dust, Dust Storms and Climate" and the references therein.

First we ran a small ensemble of simulations with the atmosphere model forced by 1920s sea surface temperatures (SSTs) to act as our base of comparison for the simulated 1930s. Next we created a small ensemble of simulations with the model forced by 1930s SSTs. This created a drought that, as is typical



for models forced by 1930s SSTs, was centered too far into the Southwest relative to the observed drought.

Then we introduced an estimate of the increased dust source from crop failure in the 1930s. This was guided by maps of wind erosion prepared in the 1930s by the newly created Soil Conservation Service. Regions of severe wind erosion were put into the model as potential dust sources although the model's dust module determines the actual lifting up, transport and deposition of the dust. The modeled dust emissions are around half the size of the scanty estimates from 1930s observations so the modeled climate impact may still be on the conservative side.

These first cut modeling experiments suggest that the Dust Bowl disaster was the result of complex interactions between humans and the environment. First changes in tropical sea surface temperatures created a drought. Poor land use practices then led to exposure of bare soil followed by wind erosion and dust storms. The dust storms interacted with radiation to make the drought worse and move it northward increasing the potential for further wind erosion.

That said, even without the human role, the drought would have occurred and the human impact was limited. However the actual dust loss in the 1930s is poorly constrained and we have also ignored so far the potential impact on climate and hydrology, through the surface radiation and moisture balances, of the vegetation loss itself. Consequently the human role in altering the Dust Bowl drought remains a topic for interesting future research.

Journal reference: Cook, B.I., R.L. Miller and R. Seager, 2008: Dust and sea surface temperature forcing of the 1930's 'Dust Bowl' drought. *Geophysical Research Letters*, Vol. 35, L08710, doi: 10.1029/2008GL033486. PDF

*Adapted from materials provided by [The Earth Institute at Columbia University](#).*

<http://www.sciencedaily.com:80/releases/2008/04/080430152030.htm>

## Engineer Develops Thermosuit For Rapid Cooling Of Critically Ill Patients



*The Thermosuit, developed by a University of Rhode Island biomedical engineer, rapidly reduces one's body temperature in emergency situations to aid in the recovery from heart attacks and other serious illnesses (Credit: University of Rhode Island/Life Recovery Systems)*

ScienceDaily (May 4, 2008) — A University of Rhode Island biomedical engineering professor has launched a company to market a unique system he co-invented that rapidly reduces one's body temperature in emergency situations to aid in recovering from heart attacks and other serious illnesses.

William Ohley, who has taught in the URI College of Engineering for 28 years, joined with medical colleagues in Louisiana and New Jersey to form Life Recovery Systems after developing what they call the Thermosuit®, a plastic suit that encases unconscious patients to flood their bodies with cold water to induce hypothermia.

“Just 10 to 20 percent of cardiac arrest patients whose hearts are restarted recover fully, primarily because the lack of blood flow to the brain causes brain damage or brain swelling,” Ohley explained. “But if doctors can rapidly induce hypothermia and reduce the patient's body temperature by three to five degrees Centigrade, their chances of a full recovery are significantly greater.”

Ohley said that it has long been understood that “being cold is good for the brain and the heart,” pointing to the many examples of individuals who are revived after nearly drowning in icy lakes, even when they were unconscious and under water for 30 minutes or more.

The challenge, he said, has been to create similar hypothermic conditions in emergency situations in hospital settings and elsewhere. Systems have been developed that blow cold air over the body or deploy ice packs, but they often take hours to reduce the body temperature to effective levels. Ohley's system takes just 30 minutes.





Since 2001, Ohley has received \$1.25 million in funding from the National Institutes of Health through its Small Business Innovation Research grants program to develop and test the device. Laboratory experiments were conducted on pigs at the University of Rhode Island in 2002 and 2003, and limited clinical trials on humans were conducted in 2005 and 2006. The Food and Drug Administration granted a 510K to allow marketing the suit as a cooling system in 2006.

The device is now being deployed in a number of hospitals around the country and internationally, and nursing and emergency room staff are being trained in its use. Hospitals using the suit report that the survival rate of patients suffering cardiac arrests has risen from 35 percent to 60 to 70 percent.

“We know that many people have already been rescued by it,” Ohley said.

Additional trials are planned at Rhode Island Hospital and elsewhere to examine its effectiveness for patients with acute myocardial infarctions or post resuscitative syndrome, the latter of which occurs when a patient’s heart has been restarted but they haven’t woken up yet. Ohley believes that stroke patients and those with brain and spinal cord injuries may also benefit from its use.

The American Heart Association’s patient care guidelines indicate that the body temperature of cardiac arrest patients should be reduced to 32-34 degrees Centigrade and held there for 12 to 24 hours.

“The speed of the cooling is particularly important,” said Ohley. “No one else makes a device that does it as quickly as our Thermosuit.”

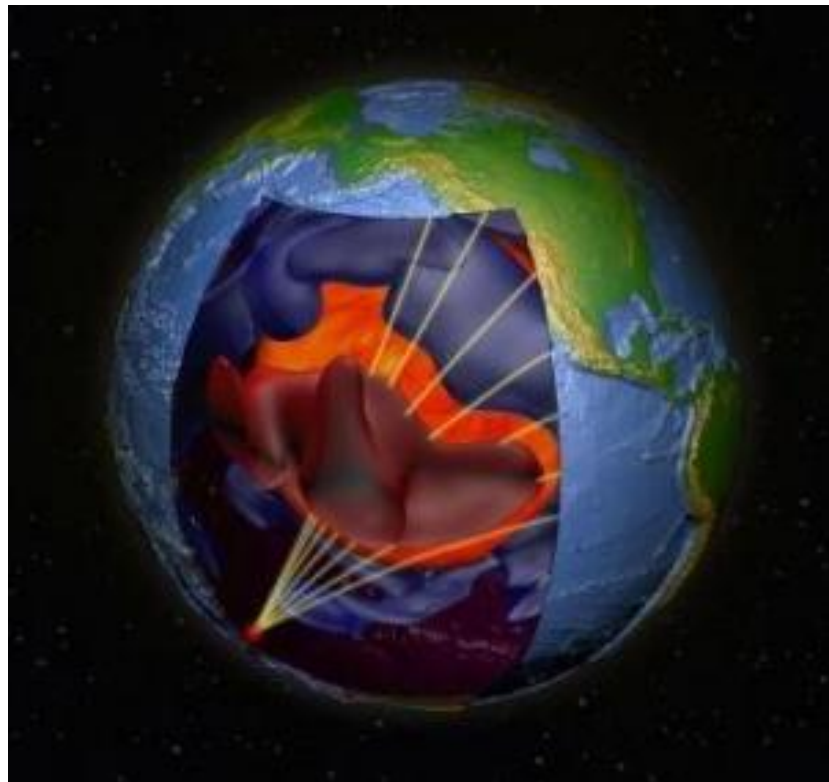
To conduct further clinical studies and continue marketing the device, Ohley and colleagues are seeking additional grant funding and outside investors

*Adapted from materials provided by University of Rhode Island.*

<http://www.sciencedaily.com:80/releases/2008/04/080430161111.htm>



## Coherent Description Of Earth's Inaccessible Interior Clarifies Mantle Motion



*The image is shown from space, centered over the Pacific Ocean, with a cut-away displaying anomalous heterogeneities in the mantle of the Earth: red and blue regions depict zones where seismic waves propagate slower or faster than average, respectively. (Credit: AAAS/Science)*

ScienceDaily (May 4, 2008) — A new model of inner Earth constructed by Arizona State University researchers pulls past information and hypotheses into a coherent story to clarify mantle motion.

"The past maybe two or three years there have been a lot of papers in Science and Nature about the deep mantle from seismologists and mineral physicists and it's getting really confusing because there are contradictions amongst the different papers," says Ed Garnero, seismologist and an associate professor in Arizona State University's School of Earth and Space Exploration.

"But we've discovered that there is a single framework that is compatible with all these different findings," he adds.

Garnero partnered with geodynamicist and assistant professor Allen McNamara, also in the School of Earth and Space Exploration in ASU's College of Liberal Arts and Sciences, to synthesize the information for their paper to be published in the May 2 issue of Science.

"Our goal was to bring the latest seismological and dynamical results together to put some constraints on the different hypotheses we have for the mantle. If you Google 'mantle' you'll see 20 different versions of what people are teaching," explains McNamara.

According to the ASU scientists, all this recent research of the past few years fits into a single story. But what is that story? Is it a complicated and exceedingly idiosyncratic story or is it a straightforward simple framework?



"In my opinion," explains Garnero, "it's simple. It doesn't really appeal to anything new; it just shows how all those things can fit together."

The pair paints a story for a chemically complex inner earth, a model that sharply contrasts the heavily relied upon paradigm of the past few decades that the mantle is all one thing and well mixed. The original model was composed of simple concentric spheres representing the core, mantle and crust -- but the inner Earth isn't that simple.

What lies beneath

Earth is made up of several layers. Its skin, the crust, extends to a depth of about 40 kilometers (25 miles). Below the crust is the mantle area, which continues to roughly halfway to the center of Earth. The mantle is the thick layer of silicate rock surrounding the dense, iron-nickel core, and it is subdivided into the upper and lower mantle, extending to a depth of about 2,900 km (1,800 miles). The outer core is beneath that and extends to 5,150 km (3,200 mi) and the inner core to about 6,400 km (4,000 mi).

The inner Earth is not a static storage space of the geologic history of our planet -- it is continuously churning and changing. How a mantle convects and how the plates move is very different depending on whether the mantle is isochemical (chemically homogenous made entirely of only one kind of material) or heterogeneous, composed of different kinds of compounds.

Garnero and McNamara's framework is based upon the assumption that the Earth's mantle is not isochemical. Garnero says new data supports a mantle that consists of more than one type of material.

"Imagine a pot of water boiling. That would be all one kind of composition. Now dump a jar of honey into that pot of water. The honey would be convecting on its own inside the water and that's a much more complicated system," McNamara explains.

Observations, modeling and predictions have shown that the deepest mantle is complex and significantly more anomalous than the rest of the lower mantle. To understand this region, seismologists analyze tomographic images constructed from seismic wave readings. For 25 years they have been detecting differences in the speeds of waves that go through the mantle.

This difference in wave speeds provides an "intangible map" of the major boundaries inside the mantle -- where hot areas are, where cold areas are, where there are regions that might be a different composition, etc. The areas with sluggish wave speeds seem to be bounded rather abruptly by areas with wave speeds that are not sluggish or delayed. An abrupt change in wave speed means that something inside the mantle has changed.

If the mantle is all the same material, then researchers shouldn't be observing the boundary between hot and cold in the mantle as a super sharp edge and the temperature anomalies should also be more spread out. The abrupt change in velocity was noticeable, yet they didn't know what caused it.

Garnero and McNamara believe that the key aspect to this story is the existence of thermo-chemical piles. On each side of the Earth there are two big, chemically distinct, dense "piles" of material that are hundreds of kilometers thick -- one beneath the Pacific and the other below the Atlantic and Africa. These piles are two nearly antipodal large low shear velocity provinces situated at the base of Earth's mantle.

"You can picture these piles like peanut butter. It is solid rock but rock under very high pressures and temperatures become soft like peanut butter so any stresses will cause it to flow," says McNamara.

Recently mineral physicists discovered that under high pressure the atoms in the rocks go through a phase transition, rearranging themselves into a tighter configuration.



In these thermo-chemical piles the layering is consistent with a new high pressure phase of the most abundant lower mantle mineral called post-perovskite, a material that exists specifically under high pressures that cause new arrangements of atoms to be formed.

Perovskite is a specific arrangement of silicon and magnesium and iron atoms.

"At a depth a few hundred kilometers above the core, the mineral physicists tell us that the rocks' atoms can go into this new structure and it should happen abruptly and that's consistent with the velocity discontinuities that the seismologists have been seeing for decades," says Garnero.

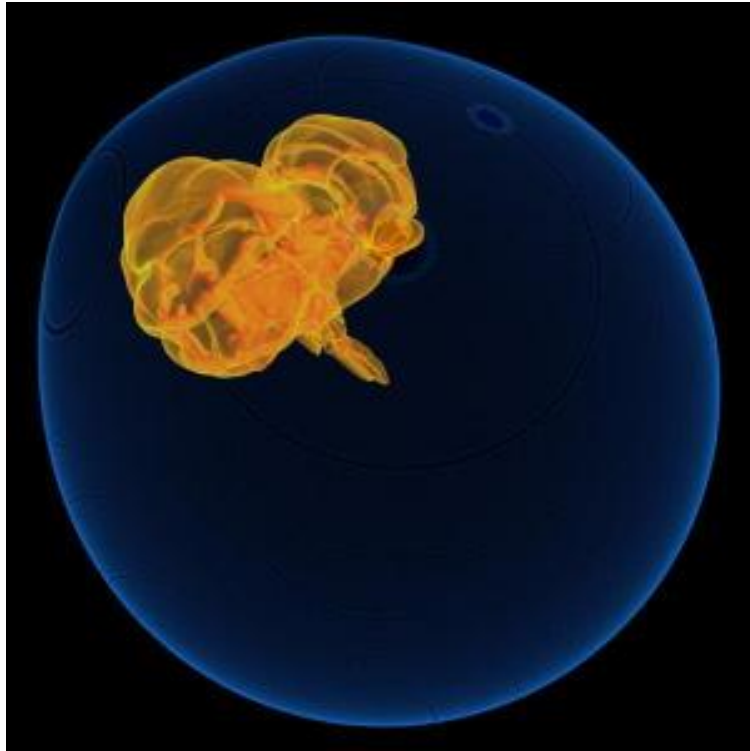
These thick piles play a key role in the convection currents. Ultra-low velocity zones live closest to the edges of the piles because that's the hottest regions of the mantle due to the currents that go against the pile walls as they bring the heat up from the core. Off their edges exist instability upwellings that turn out to be the plumes that feed hot spots such as Hawaii, Iceland and the Galapagos.

"We observe the motions of plate tectonics very well, but we can't fully understand how the mantle is causing these motions until we better understand how the mantle itself is convecting," says McNamara. "The piles dictate how the convective cycles happen, how the currents circulate. If you don't have piles then convection will be completely different."

*Adapted from materials provided by [Arizona State University](#).*

<http://www.sciencedaily.com:80/releases/2008/05/080501154212.htm>

## Supercomputer To Simulate Extreme Stellar Physics



*A snapshot of a three-dimensional simulation of a Type Ia supernova, shortly after the nuclear flame bubble that initiates the Ia event is ignited slightly off-center from the progenitor white dwarf star (shown here as a light blue surface). Buoyancy forces drive the bubble (shown in yellow and red) rapidly to the surface of the white dwarf. The bubble, consisting of nuclear ash heated to hundreds of millions of degrees, reaches a speed of nearly 2 million miles per hour before erupting from the surface roughly a second after ignition. (Credit: DOE NNSA ASC/Alliance Flash Center at the University of Chicago.)*

ScienceDaily (May 3, 2008) — Robert Fisher and Cal Jordan are among a team of scientists who will expend 22 million computational hours during the next year on one of the world's most powerful supercomputers, simulating an event that takes less than five seconds.

Fisher and Jordan require such resources in their field of extreme science. Their work at the University of Chicago's Center for Astrophysical Thermonuclear Flashes explores how the laws of nature unfold in natural phenomena at unimaginably extreme temperatures and pressures. The Blue Gene/P supercomputer at Argonne National Laboratory will serve as one of their primary tools for studying exploding stars.

“The Argonne Blue Gene/P supercomputer is one of the largest and fastest supercomputers in the world,” said Fisher, a Flash Center Research Scientist. “It has massive computational resources that are not available on smaller platforms elsewhere.”

Desktop computers typically contain only one or two processors; Blue Gene/P has more than 160,000 processors. What a desktop computer could accomplish in a thousand years, the Blue Gene/P supercomputer can perform in three days. “It's a different scale of computation. It's computation at the cutting edge of science,” Fisher said.

Access to Blue Gene/P, housed at the Argonne Advanced Leadership Computing Facility, was made possible by a time allocation from the U.S. Department of Energy's Innovative and Novel Computational Impact on Theory and Experiment program. The Flash Center was founded in 1997 with a grant from the National Nuclear Security Administration's Office of Advanced Simulation and Computing. The NNSA's



Academic Strategic Alliance Program has sustained the Flash Center with funding and computing resources throughout its history.

The support stems from the DOE's interest in the physics that take place at extremes of concentrated energy, including exploding stars called supernovas. The Flash Center will devote its computer allocation to studying Type Ia supernovas, in which temperatures reach billions of degrees. A better understanding of Type Ia supernovas is critical to solving the mystery of dark energy, one of the grandest challenges facing today's cosmologists. Dark energy is somehow causing the universe to expand at an accelerating rate.

Cosmologists discovered dark energy by using Type Ia supernovas as cosmic measuring devices. All Type Ia supernovas display approximately the same brightness, so scientists could assess the distance of the exploding stars' home galaxies accordingly. Nevertheless, these supernovas display a variation of approximately 15 percent.

"To really understand dark energy, you have to nail this variation to about 1 percent," said Jordan, a Flash Center Research Associate. The density of white dwarf stars, from which Type Ia supernovas evolve, is equally extreme. When stars the size of the sun reach the ends of their lives, they have shed most of their mass and leave behind an inert core about the size of the moon. "If one were able to scoop out a cubic centimeter—roughly a teaspoon—of material from that white dwarf, it would weigh a thousand metric tons," Fisher explained. "These are incredibly dense objects."

Type Ia supernovas are believed to only occur in binary star systems, those in which two stars orbit one another. When a binary white dwarf has gravitationally pulled enough matter off its companion star, an explosion ensues. "This takes place over hundreds of millions of years," Jordan said. "As the white dwarf becomes more and more dense with matter compressing on top of it, an ignition takes place in its core. This ignition burns through the star and eventually leads to a huge explosion."

The Flash team conducts whole-star simulations on a supercomputer at Lawrence Berkeley National Laboratory in California. At Argonne, the team will perform a related set of simulations. "You can think of them as a nuclear 'flame in a box' in a small chunk of the full white dwarf," Fisher said.

In the simulations at Argonne, the team will analyze how burning occurs in four possible scenarios that lead to Type Ia supernovas. Burning in a white dwarf can occur as a deflagration or as a detonation.

"Imagine a pool of gasoline and throw a match on it. That kind of burning across the pool of gasoline is a deflagration," Jordan said. "A detonation is simply if you were to light a stick of dynamite and allow it to explode."

In the Flash Center scenario, deflagration starts off-center of the star's core. The burning creates a hot bubble of less dense ash that pops out the side due to buoyancy, like a piece of Styrofoam submerged in water. But gravity holds the ash close to the surface of the white dwarf. "This fast-moving ash stays confined to the surface, flows around the white dwarf and collides on the opposite side of breakout," Jordan said.

The collision triggers a detonation that incinerates the star. There are, however, three other scenarios to consider. "To understand how the simulations relate to the actual supernovae, we have to do more than a thousand different simulations this year to vary the parameters within the models to see how the parameters affect the supernovae," Jordan said.

*Adapted from materials provided by [University of Chicago](http://www.science.uchicago.edu).*

<http://www.sciencedaily.com:80/releases/2008/05/080502133106.htm>

## Geochemists Challenge Key Theory Regarding Earth's Formation



*Munir Humayun with Inductively Coupled Plasma Mass Spectrometer (ICP-MS) in the new Plasma Analytical Facility in the Geochemistry section of the National High Magnetic Field Laboratory. (Credit: Image courtesy of Florida State University)*

ScienceDaily (May 3, 2008) — Working with colleagues from NASA, a Florida State University researcher has published a paper that calls into question three decades of conventional wisdom regarding some of the physical processes that helped shape the Earth as we know it today.

Munir Humayun, an associate professor in FSU's Department of Geological Sciences and a researcher at the National High Magnetic Field Laboratory, co-authored a paper, "Partitioning of Palladium at High Pressures and Temperatures During Core Formation," that was recently published in the peer-reviewed science journal *Nature Geoscience*. The paper provides a direct challenge to the popular "late veneer hypothesis," a theory which suggests that all of our water, as well as several so-called "iron-loving" elements, were added to the Earth late in its formation by impacts with icy comets, meteorites and other passing objects.

"For 30 years, the late-veneer hypothesis has been the dominant paradigm for understanding Earth's early history, and our ultimate origins," Humayun said. "Now, with our latest research, we're suggesting that the late-veneer hypothesis may not be the only way of explaining the presence of certain elements in the Earth's crust and mantle."

To illustrate his point, Humayun points to what is known about the Earth's composition.

"We know that the Earth has an iron-rich core that accounts for about one-third of its total mass," he said. "Surrounding this core is a rocky mantle that accounts for most of the remaining two-thirds," with the thin crust of the Earth's surface making up the rest.

"According to the late-veneer hypothesis, most of the original iron-loving, or siderophile, elements" -- those elements such as gold, platinum, palladium and iridium that bond most readily with iron -- "would have been drawn down to the core over tens of millions of years and thereby removed from the Earth's crust and mantle. The amounts of siderophile elements that we see today, then, would have been supplied



after the core was formed by later meteorite bombardment. This bombardment also would have brought in water, carbon and other materials essential for life, the oceans and the atmosphere."

To test the hypothesis, Humayun and his NASA colleagues -- Kevin Righter and Lisa Danielson -- conducted experiments at Johnson Space Center in Houston and the National High Magnetic Field Laboratory in Tallahassee. At the Johnson Space Center, Righter and Danielson used a massive 880-ton press to expose samples of rock containing palladium -- a metal commonly used in catalytic converters -- to extremes of heat and temperature equal to those found more than 300 miles inside the Earth. The samples were then brought to the magnet lab, where Humayun used a highly sensitive analytical tool known as an inductively coupled plasma mass spectrometer, or ICP-MS, to measure the distribution of palladium within the sample.

"At the highest pressures and temperatures, our experiments found palladium in the same relative proportions between rock and metal as is observed in the natural world," Humayun said. "Put another way, the distribution of palladium and other siderophile elements in the Earth's mantle can be explained by means other than millions of years of meteorite bombardment."

The potential ramifications of his team's research are significant, Humayun said.

"This work will have important consequences for geologists' thinking about core formation, the core's present relation to the mantle, and the bombardment history of the early Earth," he said. "It also could lead us to rethink the origins of life on our planet."

*Adapted from materials provided by [Florida State University](#).*

<http://www.sciencedaily.com:80/releases/2008/05/080501093513.htm>





### **New 'Weapon' In Forensics: Device Detects Latent Prints On Human Skin**

ScienceDaily (May 3, 2008) — Fingerprints that used to escape detection could soon help point to the killer. Using a field portable system being developed by ChemImage and Oak Ridge National Laboratory, investigators at crime scenes will be able to detect latent prints on human skin.

The system takes advantage of surface-enhanced Raman spectroscopy (SERS)-based agents to visualize latent prints. A team led by Linda Lewis of ORNL's Chemical Sciences Division is working with ChemImage to identify fingerprint components that are SERS active, which involves identifying the fingerprint components that give a Raman emission when using a SERS reagent.

The ORNL team has identified a novel dielectric nanowire coated with silver as the SERS agent of choice. This material was developed at Naval Research Laboratory.

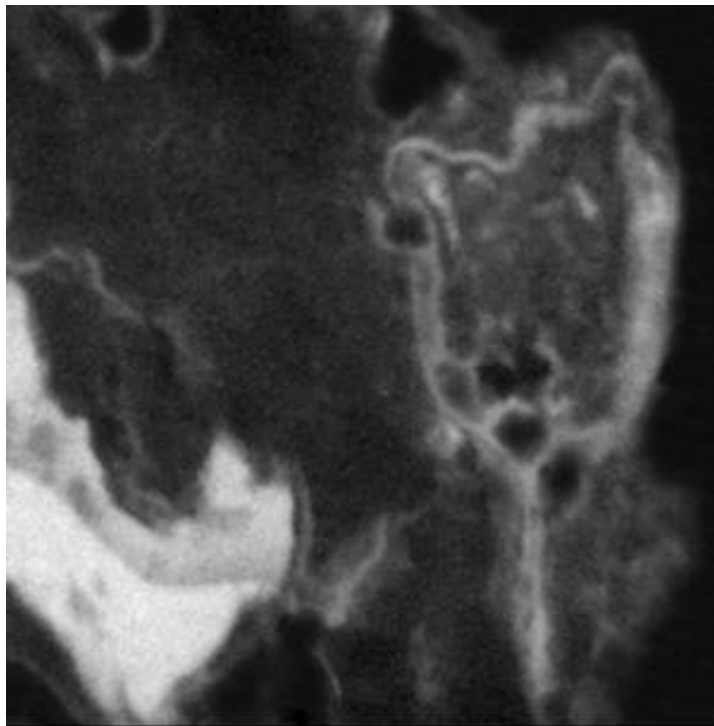
The ORNL team is now assisting Naval Research Laboratory with developing a batch processing method for producing highly active silver-coated nanowires to support a robust field method of chemically imaging latent fingerprints.

ChemImage, based in Pittsburgh, has a diverse portfolio of chemical imaging technologies and envisions this technology being used by law enforcement agencies nationwide.

*Adapted from materials provided by DOE/Oak Ridge National Laboratory.*

<http://www.sciencedaily.com:80/releases/2008/05/080501110025.htm>

### First Nanoscale Image Of Soil Reveals An 'Incredible' Variety, Rich With Patterns



*A nanoscale image of a carbon distribution map in a soil microaggregate. (Credit: Image courtesy of Cornell University)*

ScienceDaily (May 1, 2008) — A handful of soil is a lot like a banana, strawberry and apple smoothie: Blended all together, it is hard to tell what's in there, especially if you have never tasted the fruits before.

But when you look at soil's organic carbon closely, it has an incredible variety of known compounds. And looking closely is exactly what Cornell researchers have done for the first time -- at a scale of 50 nanometers (1 nanometer equals the width of three silicon atoms). Until now, handfuls of soil humus (or the organic component of soil, formed by the decomposition of leaves and other plant material by soil microorganisms) looked remarkably similar.

According to a study published in the April issue of *Nature Geoscience*, knowing the structure and detailed composition of soil carbon could provide a better understanding of the chemical processes that cycle organic matter in soil. For example, the research may help scientists understand what happens when materials in the soil get wet, warm or cool and how soils sequester carbon, which has implications for climate change.

"There is this incredible nanoscale heterogeneity of organic matter in terms of soil," said Johannes Lehmann, a Cornell associate professor of crop and soil sciences and lead author of the study. "None of these compounds that you can see on a nanoscale level looks anything close to the sum of the entire organic matter."

The soil measurements (actually, images produced by a highly focused X-ray beam) were made at the National Synchrotron Light Source at Brookhaven National Laboratory using an X-ray spectromicroscopy method developed by physicists at the State University of New York, Stony Brook. The method allowed the researchers to identify forms of organic carbon in the samples.



While the composition of organic carbon in soils from North America, Panama, Brazil, Kenya or New Zealand proved remarkably similar within each sample, the researchers found that within spaces separated by mere micrometers, soils from any of these locations showed striking variation in their compositions. For example, the compounds that "hang on the right and left of a clay mineral may be completely different," said Lehmann.

The researchers were also able to identify the origins of some of the nano-sized compounds, determining that some of them, for example, were microbe excretions and decomposed leaves.

The researchers also recognized patterns of where types of compounds are likely to be found at the nanoscale.

"Now we can start locating certain compounds," Lehmann said. "We find black carbon as distinct particles in pores, whereas we find microbial products smeared around surfaces of minerals."

The method now allows researchers to break soil down, separate compounds, conduct experiments on individual compounds and better understand the interactions, Lehmann said.

The research was funded by the National Science Foundation.

*Adapted from materials provided by Cornell University.*

<http://www.sciencedaily.com:80/releases/2008/04/080428104525.htm>

## Scientists Head To Warming Alaska On Ice Core Expedition



*The Saint Elias Mountains from the window of a Twin Otter aircraft en route to an ice core drill site in May 2002. Scientists have been gathering a series of ice cores from around the Arctic to better understand the regional climate-change picture. (Credit: Photo by Cameron Wake, UNH)*

ScienceDaily (May 1, 2008) — The state of Alaska has the dubious distinction of leading the lower 48 in the effects of a warming climate. Small villages are slipping into the sea due to coastal erosion, soggy permafrost is cracking buildings and trapping trucks.

In an effort to better understand how the Pacific Northwest fits into the larger climate-change picture, scientists from the University of New Hampshire and University of Maine are heading to Denali National Park on the second leg of a multi-year mission to recover ice cores from glaciers in the Alaska wilderness.

Cameron Wake of the UNH Institute for the Study of Earth, Oceans, and Space (EOS) and Karl Kreutz of the University of Maine Climate Change Institute are leading the expedition.

This year's month-long reconnaissance mission will identify specific drill sites for surface-to-bedrock ice cores that will provide researchers with the best climate records going back some 2,000 years. The fieldwork is part of a decade-long goal to gather climate records from ice cores from around the entire Arctic region.

"Just as any one meteorological station can't tell you about regional or hemispheric climate change, a series of ice cores is needed to understand the regional climate variability in the Arctic," says Wake, research associate professor at UNH. "This effort is part of a broader strategy that will give us a fuller picture."

Kreutz says the 2,000-year ice core record will provide a good window for determining how the climate system has been affected by volcanic activity, the variability of solar energy, changes in greenhouse gas



concentrations and the dust and aerosols in the atmosphere that affect how much sunlight reaches the Earth.

"This is a joint effort in the truest sense," says Kreutz, who has collaborated with Wake in both Arctic and Asian research for the better part of a decade. Kreutz's UMaine team will consist of Erich Osterberg, who received his Ph.D. in December, second-year M.S. candidate Ben Gross, and Seth Campbell, an undergraduate majoring in Earth science.

Wake conducted an initial aerial survey of the Denali terrain two years ago but notes there have been "no boots on the ground." Through May, Wake, his Ph.D. student Eric Kelsey, the UMaine team, and Canadian ice-core driller Mike Waszkiewicz will visit potential deep drilling sites and use a portable, ground-penetrating radar to determine the ice thickness and internal structure on specific glaciers. They will be looking for "layer-cake" ice with clear, well-defined annual stratigraphy.

A clear record from Denali will help round out the bigger paleoclimate picture by adding critical information gathered from ice cores recovered in the North Pacific, all of which can be compared to a wealth of climate data already gathered in the North Atlantic region.

According to Wake, scientists have long thought the North Atlantic drives global climate changes. However, there are now indications that a change in the North Pacific might happen first and be followed by a North Atlantic response. "We need to better understand the relationship in terms of the timing and magnitude of climate change between these two regions," he says.

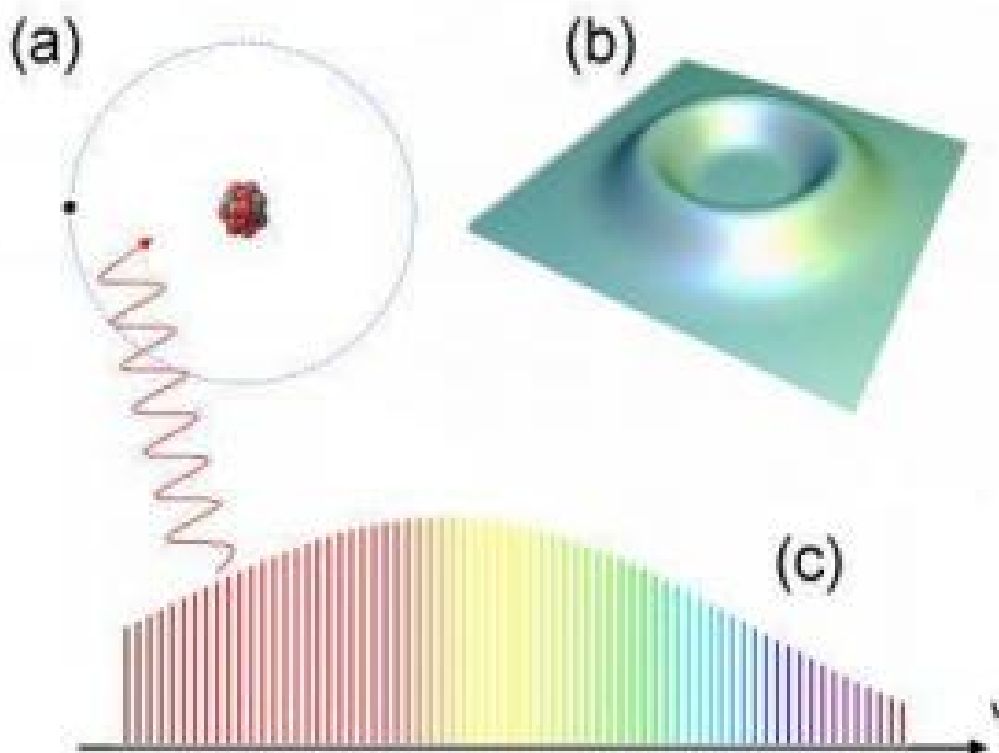
At the potential drill sites, the scientists will also collect samples for chemical analysis from 20-foot-deep snowpits and shallow ice cores, and install automatic weather stations at 7,800 feet and 14,000 feet. The chemical analyses, which will be carried out at both UNH and UMaine labs, are needed to decipher changes in temperature, atmospheric circulation, and environmental change such as the phenomenon known as "Arctic haze," which has brought heavily polluted air masses to the region for decades from North America, Europe, and Asia.

The mission is funded by the National Science Foundation.

*Adapted from materials provided by [University of New Hampshire](http://www.unh.edu).*

<http://www.sciencedaily.com:80/releases/2008/04/080429120817.htm>

## High-flying Electrons May Provide New Test Of Quantum Theory



(a) In a Rydberg atom, an electron (black dot) is far away from the atomic nucleus (red and grey core). (b) Probability map for an electron in a Rydberg atom shows that it has virtually no probability of being near the nucleus in the center. (c) An optical frequency comb for producing ultraprecise colors of light can trigger quantum energy jumps useful for accurately measuring the Rydberg constant. (Credit: NIST)

ScienceDaily (May 1, 2008) — Researchers at the National Institute of Standards and Technology (NIST) and Max Planck Institute for Physics in Germany believe they can achieve a significant increase in the accuracy of one of the fundamental constants of nature by boosting an electron to an orbit as far as possible from the atomic nucleus that binds it. The experiment, outlined in a new paper,\* would not only mean more accurate identifications of elements in everything from stars to environmental pollutants but also could put the modern theory of the atom to the most stringent tests yet.

The physicists' quarry is the Rydberg constant, the quantity that specifies the precise color of light that is emitted when an electron jumps from one energy level to another in an atom. The current value of the Rydberg constant comes from comparing theory and experiment for 23 different kinds of energy jumps in hydrogen and deuterium atoms. Researchers have experimentally measured the frequencies of light emitted by these atomic transitions (energy jumps) to an accuracy of as high as 14 parts per quadrillion (one followed by 15 zeros), but the value of the Rydberg constant is known only to about 6.6 parts in a trillion--500 times less accurate.

The main hurdle to a more accurate value comes from uncertainties in the size of the atom's nucleus, which can alter the electron's energy levels and therefore modify the frequency of light it emits. Another source of uncertainty comes from the fact that electrons sometimes emit and reabsorb short-lived "virtual photons," a process that also can slightly change the electron's energy level.



To beat these problems, NIST physicist Peter Mohr and his colleagues propose engineering so-called hydrogen-like Rydberg atoms--atomic nuclei stripped of all but a single electron in a high-lying energy level far away from the nucleus. In such atoms, the electron is so far away from the nucleus that the latter's size is negligible, and the electron would accelerate less in its high-flung orbit, reducing the effects of "virtual photons" it emits. These simplifications allow theoretical uncertainties to be as small as tens of parts in a quintillion (one followed by 18 zeros).

NIST researchers Joseph Tan and colleagues hope to implement this approach experimentally in their Electron Beam Ion Trap Facility. The idea would be to strip an atom of all its electrons, cool it and inject a single electron in a high-flying orbit. Then the researchers would use a sensitive measurement device known as a frequency comb to measure the light absorbed by this Rydberg atom. The result could be an ultraprecise frequency measurement that would yield an improved value for the Rydberg constant. Such a measurement would be so sensitive that it could reveal anomalies in quantum electrodynamics, the modern theory of the atom.

\* U.D. Jentschura, P.J. Mohr, J.N. Tan and B.J. Wundt, Fundamental constants and tests of theory in Rydberg states of hydrogen-like ions, *Physical Review Letters*, 100, 160404 (2008), posted online April 22, 2008.

*Adapted from materials provided by National Institute of Standards and Technology.*

<http://www.sciencedaily.com:80/releases/2008/04/080429170954.htm>



## Artificial Intelligence Boosts Science From Mars



*Mars Express left Earth for Mars on a six-month journey in June 2003, when the positions of the two planets made for the shortest possible route, a condition that occurs once every twenty-six months. (Credit: ESA - Illustration by Medialab)*

ScienceDaily (May 1, 2008) — Artificial intelligence (AI) being used at the European Space Operations Centre is giving a powerful boost to ESA's Mars Express as it searches for signs of past or present life on the Red Planet. Since January 2005, Mars Express has been using its sophisticated instruments to study the atmosphere, surface and subsurface of Mars, confirming the presence of water and looking for other signatures of life on and below the Red Planet's rocky terrain.

The spacecraft generates huge volumes of scientific data, which must be downloaded to Earth at the right time and in the correct sequence, otherwise data packets can be permanently lost when the limited on-board memory is overwritten by newly collected data.

Traditionally, data downloading was managed using human-operated scheduling software to generate command sequences sent to Mars Express, telling it when to dump specific data packets. "This is tedious, time-consuming and never really eliminated the occasional loss - forever - of valuable science data," says Alessandro Donati, Head of the Advanced Mission Concepts and Technologies Office at ESA's Space Operations Centre (ESOC), Darmstadt, Germany.

### Complex, dynamic problem





Donati says the downloading problem involves several constantly changing variables, including spacecraft orientation, ground station availability, space-ground communication bandwidth, on-board storage availability and the varying amounts of data generated by each of the seven on-board instruments. All these must be optimised in very short time - often with as little as a few hours between ground station passes.

But since 2005, AI researchers at Italy's Institute for Cognitive Science and Technology (ISTC-CNR) led by Dr Amedeo Cesta and mission planners and computer scientists at ESOC have been developing a solution to the complex Mars Express scheduling problem by applying artificial intelligence (AI) techniques to the problem. These are similar to those used to solve scheduling and optimisation problems faced by airlines, shipping companies and large construction projects.

### **AI for Mars Express: MEXAR2**

The result of this work is a new 'smart' tool, dubbed MEXAR2 ('Mars Express AI Tool'), which has successfully passed initial testing and validation and is now an integral part of the Mars Express mission planning system.

MEXAR2 works by considering the variables that affect data downloading - including the overall science observation schedule for all Mars Express instruments - and then intelligently projecting which on-board data packets might be later lost due to memory conflicts. It then optimises the data download schedule and generates the commands needed to implement the download. "With MEXAR2, any loss of stored data packets has been largely eliminated," says Fred Jansen, ESA's mission manager for Mars Express.

### **Europe's first deep-space mission to fly with AI**

MEXAR2 has reduced the mission planning team's workload considerably - by 50 percent compared to the old manual method - for generating workable downlink plans. "And because it optimises bandwidth used to receive data on Earth, we have been able to free expensive ground station time for other missions," says Michel Denis, Mars Express Spacecraft Operations Manager at ESOC.

MEXAR2 recently won the 'best application' award at ICAPS 2007, a benchmark international conference for AI planning & scheduling technology.

"During MEXAR2's development, the flexibility of AI-based technology let us capture many specific requirements that would otherwise have needed costly software specification redesign" says Nicola Policella, AI research fellow at ESOC. "The use of a model-based approach enabled us to rapidly improve the software prototype to produce an effective mission planning application in a short time."

MEXAR2 was also recently mentioned as one of three outstanding AI applications for mission operations by Dr Ari Kristinn Jónsson, formerly a research scientist at NASA's Ames Research Center, in a keynote speech given at iSAIRAS 2008, the 9th International Symposium on Artificial Intelligence, Robotics and Automation for Space.

"It should be noted, that - like the very few other AI tools in spacecraft operations - MEXAR2 is a trailblazer in bringing AI technology to spacecraft operations. The effectiveness of the tool and the benefits it has provided are therefore significant accomplishments in themselves," says Dr Jónsson, who is now Dean of the School of Computer Science at Reykjavik University, Iceland.

Artificial intelligence provides solutions for complex problems, and has now entered the space mission operations field as a value-adding technology. "Mars Express is the first European deep-space exploration mission to fly using an AI tool on the ground, and the technology is boosting science return while reducing time and resource costs," adds Donati.



### **AI can help solve other mission operations problems**

With MEXAR2's proven success, scientists at both ESOC and ISTC-CNR are working to apply the current AI technology to other problems.

Successful recent work includes the reverse problem of how to optimise the upload of commands to Mars Express, in a project dubbed - somewhat tongue-in-cheek - as 'RAXEM' - for the 'Reverse of MEXAR'.

ESA-developed AI technology will also be applied to the 'Advanced Planning & Scheduling Initiative', which is designed to provide AI benefits to other areas and missions, including long term observation for ESA's Integral, an orbiting space observatory mission.

"It's possible to apply the same AI concepts to future missions, like ExoMars, Europe's first planetary rover mission to the Red Planet," says Donati, adding, "Today's achievement is the starting point for implementing new on-board autonomy concepts for ESA's challenging missions of the future."

*Adapted from materials provided by European Space Agency.*

<http://www.sciencedaily.com:80/releases/2008/04/080429120900.htm>

## Boost For 'Green Plastics' From Plants



*Compounds from oilseeds could be used to make plastics and other products. (Credit: CSIRO)*

ScienceDaily (Apr. 30, 2008) — Australian researchers are a step closer to turning plants into 'biofactories' capable of producing oils which can be used to replace petrochemicals used to manufacture a range of products.

Scientists working within the joint CSIRO/Grains Research and Development Corporation Crop Biofactories Initiative (CBI) have achieved a major advance by accumulating 30 per cent of an unusual fatty acid (UFA) in the model plant, *Arabidopsis*.

UFAs are usually sourced from petrochemicals to produce plastics, paints and cosmetics. CBI is developing new technologies for making a range of UFAs in oilseeds, to provide Australia with a head start in the emerging 'bioeconomy'.

"Using crops as biofactories has many advantages, beyond the replacement of dwindling petrochemical resources," says the leader of the crop development team, CSIRO's Dr Allan Green. "Global challenges such as population growth, climate change and the switch from non-renewable resources are opening up many more opportunities for bio-based products."

The production of biofactory plants can be matched to demand and will provide farmers with new, high-value crops bred to suit their growing conditions. The technology is low greenhouse gas generating, sustainable and can reinvigorate agribusiness.



“We are confident we have the right genes, an understanding of the biosynthesis pathways and the right breeding skills to produce an oilseed plant with commercially viable UFA levels in the near future,” Dr Green says.

“Safflower is an ideal plant for industrial production for Australia,” Dr Green says. “It is hardy and easy to grow, widely adapted to Australian production regions and easily isolated from food production systems.”

The CBI is a 12-year project which aims to add value to the Australian agricultural and chemical industries by developing technologies to produce novel industrial compounds from genetically modified oilseed crops.

The project focuses on three key areas; Industrial Oils, Complex Monomers and Protein Biopolymers. CBI project leaders will present the latest research findings in each of these three areas at the WCIBB in Chicago which will showcase innovations in the convergence of biotechnology, chemistry and agriculture.

The team will announce the successful completion of the first stage of the CBI on 28 April during the Fifth Annual World Congress on Industrial Biotechnology & Bioprocessing (WCIBB), being held in Chicago, Illinois, from 27-30 April 2008.

*Adapted from materials provided by CSIRO Australia.*

<http://www.sciencedaily.com:80/releases/2008/04/080429085916.htm>

## Virtual World Therapeutic For Addicts: Study Shows Impact Of Environment To Addiction Cravings



Participant (left) wears the VR helmet and is guided by a monitor through the virtual environments. (Credit: Professor Patrick Bordnick)

ScienceDaily (Apr. 30, 2008) — Patients in therapy to overcome addictions have a new arena to test their coping skills--the virtual world. A new study by University of Houston Associate Professor Patrick Bordnick found that a virtual reality (VR) environment can provide the climate necessary to spark an alcohol craving so that patients can practice how to say "no" in a realistic and safe setting.

"As a therapist, I can tell you to pretend my office is a bar, and I can ask you to close your eyes and imagine the environment, but you'll know that it's not real," Bordnick said. "In this virtual environment you are at a bar or at a party or in a real-life situation. What we found was that participants had real-life responses."

Bordnick, of the UH Graduate College of Social Work, investigates VR as a tool for assessing and treating addictions. He studied 40 alcohol-dependent people who were not receiving treatment (32 men and eight women). Wearing a VR helmet, each was guided through 18 minutes of virtual social environments that included drinking. The participant's drink of choice was included in each scene. Using a game pad, each rated his or her cravings and attention to the alcohol details in each room. Each then was interviewed following the experience.

"What we found was that the VR environments were real enough that their cravings were intensified. So, now we can develop coping skills, practice them in those very realistic environments until those skills are working tools for them to use in real life," Bordnick said.

His VR environments, developed with a company called Virtually Better, feature different scenarios that an addict may find challenging: a bar with imbibing patrons, a house party with guests drinking and smoking, a convenient store with cigarettes and alcoholic beverages within reach, a designated smoking section outside of a building or a room with an arguing couple. The environments use actors in each scene



as opposed to computer-generated characters. In addition, the study added another layer of realism. A device sprayed the air with scents the participant may encounter in the various scenarios--cigarette smoke, alcoholic beverages, pizza or aromas associated with the outdoors.

"This study shows us the value of using virtual reality as a tool for assessing and treating addictions. Future studies should explore the importance of environmental settings and other cues on cravings and relapse," Bordnick said.

His study is available online in the journal *Addictive Behaviors*. Bordnick also has VR environments to help soldiers from Iraq, those with a fear of flying, fear of public speaking and fear of heights.

He is funded by the National Institutes of Health, the National Institute on Drug Abuse and the National Institutes for Alcohol Abuse and Alcoholism.

*Adapted from materials provided by University of Houston, via EurekAlert!, a service of AAAS.*

<http://www.sciencedaily.com:80/releases/2008/04/080428175336.htm>

## 'New' Ancient Antarctic Sediment Reveals Climate Change History



*FSU geological sciences Professor Sherwood W. Wise, Jr. of the Antarctic Marine Geology Research Facility (left), AMGRF curator Simon Nielsen (center), and former AMGRF curator Matthew Olney (right) standing in the facility's massive cold-storage vault. (Credit: FSU Photo Lab / Bill Lax)*

ScienceDaily (Apr. 30, 2008) — Recent additions to the premier collection of Southern Ocean sediment cores at Florida State University's Antarctic Marine Geology Research Facility will give international scientists a close-up look at fluctuations that occurred in Antarctica's ice sheet and marine and terrestrial life as the climate cooled considerably between 20 and 14 million years ago.

FSU's latest Antarctic sediment core acquisition was extracted from deep beneath the sea floor of Antarctica's western Ross Sea, the Earth's largest floating ice body. The new samples -- segments of a drill core that measures more than 1,100 meters in length -- offer an extraordinary stratigraphic record of sedimentary rock from the Antarctic continental margin that documents key developments in the area's Cenozoic climatic and glacial history.

By correlating that stratigraphic record with existing data and climate and ice sheet models, scientists from FSU and around the world expect to learn how local changes in the Southern Ocean region relate to regional and global climate events.

"Such knowledge will significantly increase our understanding of Antarctica's potential responses to future global-scale climate changes," said Sherwood W. Wise, Jr., an FSU geological science professor and co-principal investigator at the Antarctic Marine Geology Research Facility. "This is critical for low-lying regions such as Florida that could be directly affected by the future behavior of the Antarctic Ice Sheets and any resulting sea-level changes. By studying these glacial records of the past, geologists and climatologists seek to better predict the future."



The new cores came to FSU compliments of ANDRILL (ANtartic geological DRILLing), an international collaboration among more than 120 scientists -- plus drillers, engineers, educators and technicians -- from Germany, Italy, New Zealand and the United States. FSU's Antarctic Marine Geology Research Facility and its staff and associated geological science faculty play a key ANDRILL role, providing both on-the-ice curatorial services during the drilling season and a permanent repository for the core samples recovered during the project.

In fact, from April 29 through May 3, some 100 ANDRILL scientists and educators, including seven from the FSU "on-ice" curatorial team, will converge at the Antarctic Marine Geology Research Facility core repository. They will re-examine the latest core acquisitions to refine their descriptions of the material and take additional samples for tests to extract even more information about their history and the conditions under which the sediments were deposited.

Those hard-won, deep-sea sediment cores may be millions of years old, but the scientists will find them in mint condition at FSU. The Antarctic research facility carefully curates the samples in its large, 6,000-square-foot refrigerated "Cold Room," which is maintained at 34 F. (i.e., sea-bottom temperatures).

"The sediment cores recovered during this year's successful ANDRILL expedition have filled in a major gap in the most direct record of the ice activity yet recovered from the period of about 20 to 14 million years ago," said Wise, who serves ANDRILL as a participating (off-ice) scientist and member of its U.S. advisory committee. "The 1,139 meters of core retrieved, 98 percent intact, records the critical transition from times warmer than today to the onset of major cooling between about 14 to 13 million years ago when a semi-permanent ice sheet formed across most of Antarctica."

That record was created, said Wise, because sediments deposited close to or beneath grounded glaciers alternate with marine sediments, providing clear evidence of cyclical ice advances followed by substantial retreats and reflecting variations in sea-level, glacial and climate fluctuations. The new stratigraphic section housed at FSU will allow scientists to devise more accurate models of the timing of past ice-sheet movements, volume changes and variability, and paleotemperature fluctuations, and will enable a better understanding of the development of Antarctica's terrestrial and marine life.

The Antarctic Marine Geology Research Facility was established at FSU in 1963 through the National Science Foundation's Office of Polar Programs and now serves as the national repository for geological material from the Southern ocean. It functions as one of the university's two user facilities (the National High Magnetic Field Laboratory is the other) for visiting researchers from around the globe.

ANDRILL's meeting April 29-May 3 will take place throughout FSU's Carraway Building -- home to the Department of Geological Sciences and the annex that houses the Antarctic Marine Geology Research Facility. During the workshop one of the two chief scientists of the second ANDRILL expedition, David M. Harwood, an FSU master's graduate (1982) and a geology professor at the University of Nebraska-Lincoln, will be honored with a special alumni award.

Visiting ANDRILL researchers who attended last May's inaugural post-drilling workshop at FSU will notice that since then the Antarctic research facility's core repository has undergone a major renovation to make room for recent acquisitions and future ones. Funding for those improvements to one of the coolest places on campus came from the National Science Foundation.

*Adapted from materials provided by [Florida State University](http://www.sciencedaily.com).*

<http://www.sciencedaily.com:80/releases/2008/04/080428175339.htm>



## How Birds Navigate: Research Team Is First To Model Photochemical Compass



An international team of researchers are the first to demonstrate that a synthesized photochemical molecule composed of linked carotenoid (C), porphyrin (P) and fullerene (F) units can act as a magnetic compass. When excited with light, CPF forms a short-lived charge-separated state with a negative charge on the ball-like fullerene unit and a positive charge on the rod-like carotenoid unit. The lifetime of the charge-separated state before it returns to its lowest energy or ground state is sensitive to the magnitude and direction of a weak magnetic field similar to Earth's. (Credit: Zina Deretsky, National Science Foundation)

ScienceDaily (Apr. 30, 2008) — It has long been known that birds and many other animals including turtles, salamanders and lobsters, use the Earth's magnetic field to navigate, but the nature of their global positioning systems (GPS) has not been completely understood.

One school of thought hypothesizes that birds use magnetically-sensitive chemical reactions initiated by light (called chemical magnetoreception) to orient themselves, but no chemical reaction in the laboratory, until now, has been shown to respond to magnetic fields as weak as the Earth's.

Scientists from Arizona State University and the University of Oxford, whose work appears in the April 30 advanced online publication of the journal *Nature*, have synthesized and studied a sophisticated molecule that, under illumination, is sensitive to both the magnitude and the direction of magnetic fields as tiny as the Earth's, which is, on average, one-twenty thousandth as strong as a refrigerator magnet.

ASU's Devens Gust, professor of chemistry and biochemistry in the College of Liberal Arts and Sciences, states that "although the chemical magnetoreception mechanism for avian magnetic navigation has been discussed by many investigators, our research provides the first proof that this mechanism can actually function with magnetic fields as small as those of the Earth."

Gust, who also is a faculty researcher in the Center for Bioenergy and Photosynthesis at ASU, says "the design, synthesis and a few initial magnetic field effect studies were done at ASU in the context of artificial photosynthetic solar energy conversion. The Oxford group, led by Peter Hore, professor of chemistry, realized that these effects might be relevant to chemical magnetoreception, constructed the



extremely sensitive apparatus needed to observe the phenomena, and carried out the appropriate experiments."

Ten years ago, a National Science Foundation-sponsored research team at Arizona State led by Gust, Thomas Moore and Ana Moore, professors of chemistry and biochemistry, synthesized a molecular "triad" and demonstrated that when the triad was exposed to light, it formed a short-lived, high-energy charge-separated species whose lifetime was influenced by magnetic fields.

The special molecules were originally synthesized as artificial photosynthetic reaction centers, being developed as chemical solar energy conversion systems. They were inspired by the way plants harvest sunlight, and had nothing whatsoever to do with bird navigation.

A related triad molecule was recently synthesized by Paul Liddell, assistant research professional working with Gust and the Moores, and studied by Hore and coworkers at the University of Oxford. The British researchers used lasers that sent out pulses of light lasting only one-thousand millionth's of a second to investigate the molecular properties. A major problem was to completely shield their experiments from the Earth's magnetic field.

The wonder molecule comprises three units (a carotene-porphyrin-fullerene triad). When excited by light, the triad molecule forms a charge-separated state with the negative charge on the soccer-ball-like fullerene (or buckyball) portion and the positive charge on the rod-like carotene portion. The lifetime of the charge-separated species before it returns to the normal state is sensitive to the magnitude and direction of a weak magnetic field, similar to that of the Earth. The triad molecule, in its charge separated state, could be thought of as having little bar magnets at either end -- so far apart that they interact with each other only weakly.

Gust and Liddell were joined in this research by Kiminori Maeda, Kevin Henbest and Christiane Timmel of the University of Oxford's inorganic chemistry laboratory and Filippo Cintolesi, Ilya Kuprov, Christopher Rodgers and Hore of Oxford's physical chemistry laboratory.

"These results provide a clear proof of principle that the magnetic compass sense of migratory birds is based on a magnetically-sensitive chemical reaction whose product yields and/or rate depend on the orientations of the molecules involved with respect to the geomagnetic field," adds Hore.

Gust also notes that understanding animal navigation systems is of great ecological importance because weak, man-made magnetic fields are produced by many widely-used technologies, such as power lines and communications equipment. In fact, this also allows for a diagnostic test of the magnetoreceptor mechanism, he says. Research has shown that both broadband radio noise (0.1-10.0 MHz) and constant frequency (7MHz) signals disrupted magnetic orientation in European robins.

"Of course," Gust adds, "this research does not prove that birds actually use this mechanism, only that they could. But, there is a large body of research on birds that is consistent with the magnetoreception idea."

The international research team is busily designing new molecules and experiments to further prove their case. This work has demonstrated that the ingenious chemical magnetoreception concept is indeed feasible. It certainly provides some insight into the structure and dynamic design features needed for a molecular interpretation of how the birds go about keeping their appointments in strange places across the world.

*Adapted from materials provided by [Arizona State University](http://www.arizona.edu).*

<http://www.sciencedaily.com:80/releases/2008/04/080430134238.htm>



## New Class Of Fatty Acids Discovered



*CSIRO researchers opening up an entirely new class of chemistry. (Credit: CSIRO)*

ScienceDaily (Apr. 30, 2008) — CSIRO researchers have discovered a new class of fatty acids – alpha-hydroxy polyacetylenic fatty acids – that could be used as sensors for detecting changes in temperature and mechanical stress loads.

CSIRO Entomology business manager, Cameron Begley, said researchers believed the discovery opened up an entirely new class of chemistry.

“Some of these alpha-hydroxy polyacetylenic fatty acids act as indicators for a range of different conditions, such as mechanical stress or heat, and display self-assembling properties. Others display anti-microbial properties,” he said.

“Australian scientists working within the Crop Biofactories Initiative (CBI) have also been developing applications for alpha-hydroxy unsaturated fatty acids (AHUs).

“Alpha-hydroxy fatty acids (AHA’s) are well known to industry, but we have found some interesting applications for AHUs. We have introduced them to a range of bio-based condensation polymer systems that have increased film flexibility. Using these AHUs we have also observed strong adhesion between polyolefins and a range of substrates.”

CBI researchers have also identified novel uses for hydroxy fatty acids and how these affect polymer properties.



The team will be outlining these discoveries on 28 April during the Fifth Annual World Congress on Industrial Biotechnology & Bioprocessing (WCIBB), being held in Chicago, Illinois, from 27-30 April 2008.

The CBI is a 12-year project which aims to add value to the Australian agricultural and chemical industries by developing technologies to produce novel industrial compounds from genetically modified oilseed crops. This Initiative is a joint venture between CSIRO and the Grains Research and Development Corporation.

The project focuses on three key areas; Industrial Oils, Complex Monomers and Protein Biopolymers. CBI project leaders will present the latest research findings in each of these three areas at the WCIBB in Chicago which will showcase innovation at the convergence of biotechnology, chemistry and agriculture.

*Adapted from materials provided by CSIRO Australia.*

<http://www.sciencedaily.com:80/releases/2008/04/080429085910.htm>

## Hyperviscous Fluids: Better Treatment For Severe Blood Loss



*The Advanced Trauma Life Support guidelines, recommend that emergency physicians first control bleeding and resuscitate with isotonic fluids. New research suggests hypertonic, hyperviscous fluids may be superior. (Credit: UC San Diego, Jacobs School of Engineering)*

ScienceDaily (Apr. 30, 2008) — Intravenous administration of isotonic fluids is the standard emergency treatment in the U.S. for patients with severe blood loss, but UC San Diego bioengineering researchers have reported improved resuscitation with a radically different approach. Building on earlier studies in humans that have shown benefits of intravenous fluids that are eight times saltier than normal saline, the researchers combined hypertonic saline with viscosity enhancers that thicken blood.

Reporting in the journal *Resuscitation* in an article that is available online, the researchers describe dramatic increases in beneficial blood flows in the small blood vessels of hamsters with the combined hypertonic saline and viscosity enhancement approach. The fluid was given to animals after as much as half of their blood was removed to simulate human blood losses on the battlefield, in traffic accidents and in operating rooms.

The team led by Marcos Intaglietta, a professor of bioengineering at the Jacobs School of Engineering, reported that the new approach sharply improved the animals' functional capillary density, a key measure of healthy blood flow through tissues and organs.

"Of course, trauma physicians want to get the blood flowing as soon as possible, and increasing the viscosity of blood may not make any sense to them," said Intaglietta. "However, our results are highly suggestive that increasing viscosity rather and partially restoring blood volume is a better way to increase blood flow through tissues. These findings also are consistent with recent discoveries showing that higher shear forces of more viscous blood leads to dilation of small blood vessels."

Treating blood loss is a critical medical issue because trauma is the leading cause of death among North Americans 1 to 44 years old. Whether injured on the freeway or wounded in battlefield, loss of 40 percent



or more of a patient's blood is immediately life-threatening. Physicians and emergency workers must act quickly.

The majority of trauma deaths are due to severe brain injury or a dangerous condition resulting from blood loss called hypovolemic shock. When too little blood flows through the body's organs, the heart begins beating rapidly, the skin becomes cold and pale, blood pressure plummets, and patients exhibit mental confusion. Hypovolemic shock can progress within a matter of one or two hours to organ failure and death.

The bible of trauma physicians and emergency workers, the Advanced Trauma Life Support (ATLS) guidelines, emphasize that physicians first control bleeding and then provide limited fluid resuscitation, a strategy known as "permissive hypotension" until control of hemorrhage is obtained. The ATLS guidelines, developed by the American College of Surgeons and adopted in more than 30 countries, were modified to lower the volume of isotonic fluids given after several studies demonstrated that sudden increases in blood pressure (without immediate bleeding control) would "pop" clots that the body forms to control bleeding.

Over several decades, studies involving humans and animals have evaluated hypertonic saline (up to 7.5 percent sodium chloride) versus isotonic saline (0.9 percent sodium chloride). Given intravenously, hypertonic solutions act like magnets, drawing fluid from tissues into the bloodstream, thereby increasing blood volume. Such hypertonic saline has not received the approval of the Food and Drug Administration for clinical use in the United States. Therefore, it is not part of ATLS guidelines.

However, several medical research teams, including one led by Dr. Raul Coimbra, professor of surgery and chief, Division of Trauma, Surgical Critical Care and Burns at UC San Diego Medical Center, have investigated the effects of hypertonic saline for almost 20 years. "Our level-1 trauma center at UC San Diego is participating in a study of hypertonic saline as part of a multicenter trial sponsored by the National Institutes of Health," said Coimbra. "Unfortunately, it will take us two to three more years to finish the trial and determine whether hypertonic saline is superior to conventional isotonic resuscitation."

In Intaglietta's study with hamsters in the Jacobs School of Engineering's Department of Bioengineering, 90 minutes after hypertonic saline was given to blood-depleted hamsters about 30 percent of normal flow was reconstituted through skin arterioles, tiny branches of arteries that lead to the even smaller capillaries. The bioengineering researchers quantified blood flow with special microscopic procedures.

In blood-depleted hamsters given both hypertonic saline and a small volume of a commercially available viscosity enhancer called Hextend®, blood flow through arterioles improved to 40 percent of normal. When the hypertonic saline, Hextend®, and a small volume of another viscosity enhancer called alginate were given, arteriole blood flow improved to 55 percent of normal. Hextend® and alginate are plasma volume expanders, substances transfused to maintain the fluid volume of blood.

"Our findings suggest that elevating the viscosity of blood after severe blood loss is beneficial in resuscitation," said Intaglietta. "In fact, our studies indicate that Hextend and similar plasma extenders could produce even greater benefit if they were formulated with higher viscosities."

Arterioles regulate blood flow by constricting and dilating. A variety of factors in the body influence the process, including the viscosity of plasma, the fluid portion of blood. For example, higher viscosity plasma causes arterioles to dilate.

"For centuries, dating back to the time of the early Greeks, the idea has always been that blood is thick, so the sick should be treated by bleeding in order to thin the blood," said Intaglietta. "Even as late as World War II and the Vietnam War, it was thought that adding isotonic fluids to replace blood lost on the battlefield would be good because it lowered blood viscosity, making it easier for the heart to pump."



Intaglietta said that while more research is needed, "Our findings and others suggest that the ATLS guidelines need to be modified."

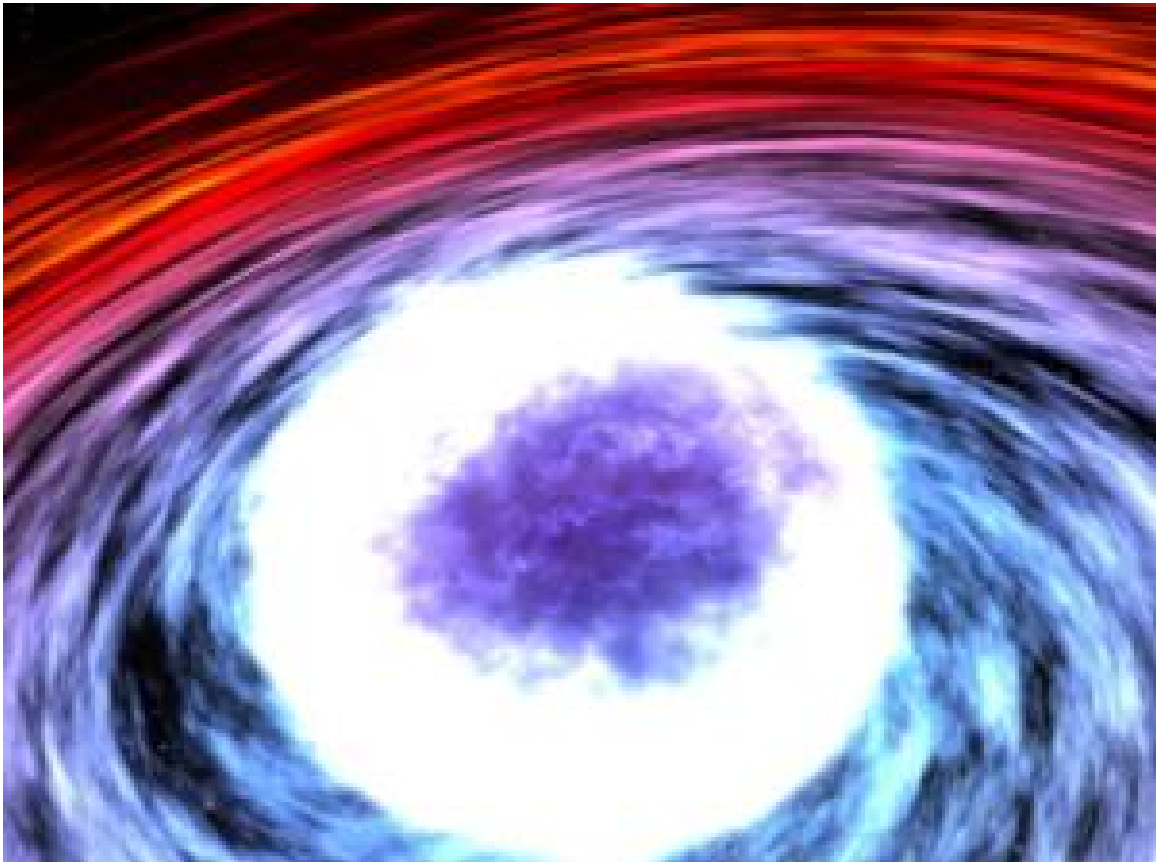
"Studies such as Intaglietta's are important because it uses not only hypertonic saline," said Coimbra, "but also other adjuncts which may increase the effects of hypertonic saline in treating those patients and in advancing our knowledge about shock resuscitation."

Co-authors of the Resuscitation report with Intaglietta are Pedro Cabrales, a senior investigator at the La Jolla Bioengineering Institute, and Amy G. Tsai, a research professor in the Jacobs School's Department of Bioengineering. The research was supported by the National Heart, Lung and Blood Institute and the U.S. Army. Dr. Coimbra's research was supported by the National Institutes of Health.

*Adapted from materials provided by University of California - San Diego, via EurekAlert!, a service of AAAS.*

<http://www.sciencedaily.com:80/releases/2008/04/080429075340.htm>

## NASA Satellite Pins Down Timer In Stellar Ticking Time Bomb



*A thermonuclear explosion as it engulfs an entire neutron star. (Credit: NASA)*

ScienceDaily (Apr. 30, 2008) — Using NASA's Rossi X-ray Timing Explorer (RXTE) satellite, a team of four astronomers has discovered a timing mechanism that tells them exactly when a superdense star will let loose incredibly powerful explosions.

"We found a clock that ticks slower and slower, and when it slows down too much, boom! The bomb explodes," says team leader Diego Altamirano of the University of Amsterdam in the Netherlands.

The explosions occur on a neutron star, which is a city-sized remnant of a giant star that exploded in a supernova. But despite the neutron star's small size, it contains more material than our sun. The neutron star is not alone in space. It has a companion star, and the two objects orbit each other every 3.8 hours. This double-star system is known as 4U 1636-53 for its sky coordinates in the Southern Hemisphere.

The system acts like a ticking time bomb. The neutron star has incredibly strong gravity, so it sucks in some of the gas from the companion star's atmosphere. The gas spirals onto the neutron star, slowly building up on its surface until it heats up to a critical temperature. Suddenly, the gas at one small spot on the neutron star's surface ignites a powerful explosion, and the flame quickly spreads around the entire star. The resulting explosion appears as a bright flash of X-rays that can be detected by satellites.

The neutron star in 4U 1636-53 produces about 7 to 10 bursts per day. These explosions are mind-boggling to contemplate. They release more energy in just 10 to 100 seconds than our sun radiates in an entire week. The energy is equivalent to 100 hydrogen bombs exploding simultaneously over each





postage-stamp-size patch of the neutron star's surface. It's a good thing for us that this neutron star is 20,000 light-years from Earth, which is far enough away that the explosions pose no danger to humans or our planet. Fortunately for the neutron star, the explosion takes place only on its surface and in its atmosphere, so the neutron star survives the blast.

Scientists have observed thousands of similar X-ray bursts from about 80 different neutron stars. But until now, they had no way to predict when they would occur.

The key to this discovery is RXTE, which makes extremely precise timing measurements of objects that emit X-rays in a rapidly flickering pattern. As gas gradually builds up on the neutron star's surface, the atoms that make up the gas slam together to form heavier atoms in a process known as fusion. Sometimes, the fusion occurs in a stable and almost perfectly repetitive fashion, producing a nearly regular X-ray signal known as a quasi-periodic oscillation (or QPO for short). Think of the QPO as a clock that ticks with near-perfect precision.

Scientists expect that the QPO clock should tick about once every two minutes (120 seconds). This is what Altamirano's team found when the astronomers observed the system with RXTE. But the team also found that the QPO clock starts ticking slower and slower as gas builds up on its surface. Whenever it slows down to one cycle every 125 seconds, the neutron star lets loose a powerful explosion.

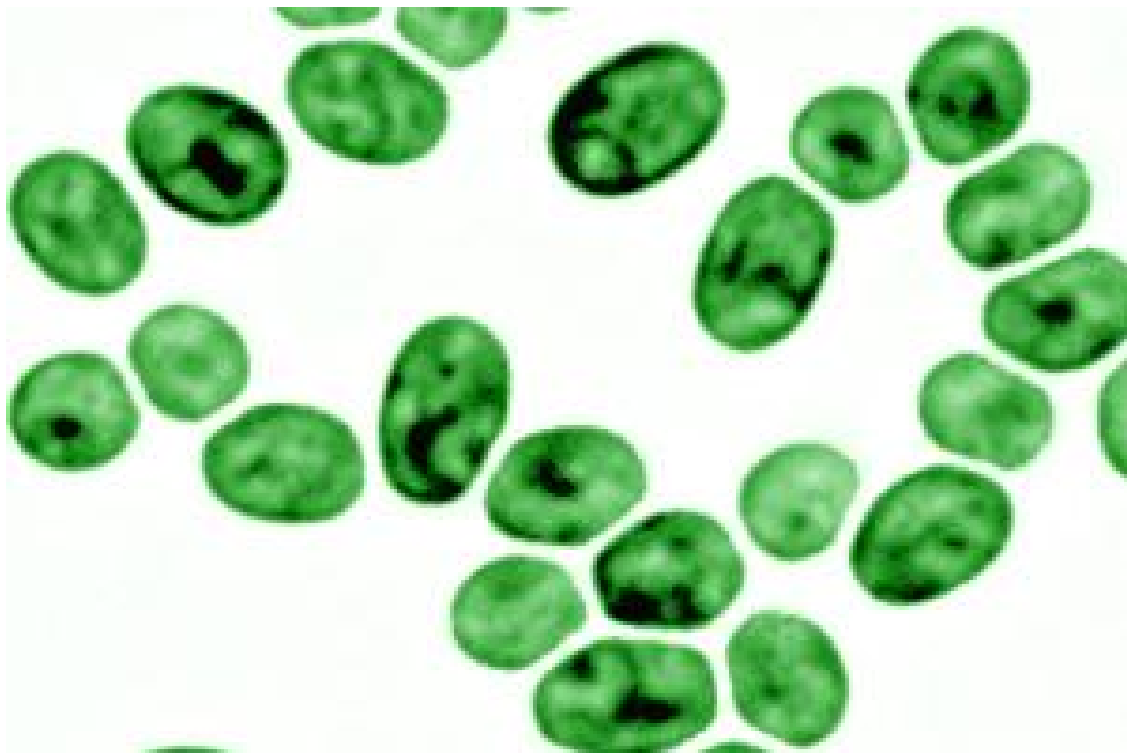
"We can predict when these explosions are happening. We have a clock that tells us when the bomb will explode!" says Altamirano.

"It's an exciting discovery," adds Tod Strohmayer of NASA's Goddard Space Flight Center in Greenbelt, Md. Strohmayer is an expert in neutron stars who was not involved in this study. He notes that the ticking of the QPO clock depends on the size and weight of the neutron star. "It gives us a new tool to study these fascinating objects," he says.

*Adapted from materials provided by [NASA/Goddard Space Flight Center](http://www.nasa.gov).*

<http://www.sciencedaily.com/80/releases/2008/04/080430112525.htm>

## Single-celled Bacterium Works 24/7



*Cyanosphaera* is a unicellular bacterium that can capture energy from light and also fix atmospheric nitrogen. As part of a daily diurnal cycle, *Cyanosphaera* stores the products of photosynthesis and nitrogen fixation so that they can be used at the proper time. This ability makes *Cyanosphaera* an ideal system to understand how a unicellular organism balances and regulates complex processes in the same cell. (Credit: Image courtesy of The Pakrasi Lab) ScienceDaily (Apr. 30, 2008) — Researchers at Washington University in St. Louis have gained the first detailed insight into the way circadian rhythms govern global gene expression in *Cyanosphaera*, a type of cyanobacterium (blue-green algae) known to cycle between photosynthesis during the day and nitrogen fixation at night.

In general, this study shows that during the day, *Cyanosphaera* increases expression of genes governing photosynthesis and sugar production, as expected. At night, however, *Cyanosphaera* ramps up the expression of genes governing a surprising number of vital processes, including energy metabolism, nitrogen fixation, respiration, the translation of messenger RNA (mRNA) to proteins and the folding of these proteins into proper configurations. The findings have implications for energy production and storage of clean, alternative biofuels.

### Bacterial biological clock

"One of the mysteries in cellular physiology is this business of rhythm," said Himadri Pakrasi, Ph.D., the George William and Irene Koechig Freiberg Professor in Arts & Sciences and lead investigator of this project. "Circadian rhythm controls many physiological processes in higher organisms, including plants and people. *Cyanosphaera* are of great interest because, even though one cell lives less than a day, dividing every 10 to 14 hours, together they have a biological clock telling them when to do what over a 24-hour period. In fact, cyanobacteria are the only bacteria known to have a circadian behavior."

Why does such a short-lived, single-celled organism care what time it is? The answer, according to this study, is that the day-night cycle has a tremendous impact on the cell's physiology, cycling on and off many vital metabolic processes, not just the obvious ones. Among the obvious cycling processes are



photosynthesis and nitrogen fixation. It is difficult for one cell to perform these two functions because the processes are at odds with one another. Fixing nitrogen requires nitrogenase, a catalyst that helps the chemical reaction move forward. Unhelpfully, the oxygen produced by photosynthesis degrades nitrogenase, making nitrogen fixation difficult or impossible in photosynthetic organisms. Other filamentous cyanobacteria perform photosynthesis and nitrogen fixation in different, separate cells. As a single-celled bacterium, however, *Cyanothece* cannot separate these antagonistic processes in space. But it can separate them in time.

Agreeing with previous studies, this study found that *Cyanothece* genes for photosynthesis turn on during the day and genes for nitrogen fixation turn on at night. The surprise is the tremendous impact the day-night cycle has on the overall physiology of the cell. "It goes far beyond just the aspects of nitrogen fixation and photosynthesis," said Pakrasi, who also directs Washington University's International Center for Advanced Renewable Energy and Sustainability (I-CARES) to encourage and coordinate university-wide and external collaborative research in the areas of renewable energy and sustainability — including biofuels, carbon dioxide mitigation and coal-related issues. The university will invest more than \$55 million in the initiative.

### **Cyanothece's 'Dark Period'**

To see the effect of day-night cycles on the overall physiology of *Cyanothece*, lead author Jana Stöckel, Ph.D., Washington University post-doctoral researcher, and other members of this research team examined the expression of 5,000 genes, measuring the amount of messenger RNA for each gene in alternating dark and light periods over 48 hours. At a given time, the mRNA levels indicated what the cells were doing. For example, when the researchers identified high levels of many mRNAs encoding various protein components of the nitrogenase enzyme, they knew that the cells were fixing nitrogen at that time, in this case, during the dark periods.

Of the 5,000 genes studied, nearly 30 percent cycled on and off with changing light and dark periods. These particular genes, the study found, also govern major metabolic processes. Therefore, the cycling of mRNA transcription, Pakrasi said, "provides deep insight into the physiological behavior of the organism — day and night." During the day, *Cyanothece* busies itself with photosynthesis. Using energy from sunlight, carbon dioxide from the atmosphere, and water, *Cyanothece* produces glucose, a sugar it stores in glycogen granules, filling its chemical gas tank. At night, the *Cyanothece* ramps up production of nitrogenase to fix nitrogen, as expected. Since nitrogen fixation requires a lot of energy, *Cyanothece* uses the glycogen stored through a process called respiration. Because respiration requires oxygen, the cells conveniently use up this by-product of photosynthesis, likely helping to protect nitrogenase from degradation.

Through this cyclic expression of genes, *Cyanothece* is essentially a living battery, storing energy from the sun for later use. This feat continues to elude scientists searching for ways to harness sunlight and produce energy on a large scale. With this in mind, a new project for the Pakrasi team seeks to use the machinery of *Cyanothece* — its energy storage strategy, its anaerobic conditions that protect important enzymes — as a biofactory to produce hydrogen from sunlight, the ultimate clean energy source.

The study was published in the April online issue of the Proceedings of the National Academy of Science. The research was funded by the U.S. Department of Energy in the context of a Biology Grand Challenge project administered by the Environmental Molecular Sciences Laboratory at the Pacific Northwest National Laboratory.

*Adapted from materials provided by [Washington University in St. Louis](http://www.washington.edu).*

<http://www.sciencedaily.com:80/releases/2008/04/080428165240.htm>



## New Findings Challenge Conventional Ideas On Evolution Of Human Diet, Natural Selection



*Researchers examined the teeth of Paranthropus boisei, also called the "Nutcracker Man," an ancient hominin that lived between 2.3 and 1.2 million years ago. The "Nutcracker Man" had the biggest, flattest cheek teeth and the thickest enamel of any known human ancestor and was thought to have a regular diet of nuts and seeds or roots and tubers. But analysis of scratches on the teeth and other tooth wear reveal the pattern of eating for the "Nutcracker Man" was more consistent with modern-day fruit-eating animals. (Credit: Nicolle Rager Fuller, National Science Foundation)*

ScienceDaily (Apr. 30, 2008) — New findings suggest that the ancient human "cousin" known as the "Nutcracker Man" wasn't regularly eating anything like nuts after all. A University of Arkansas professor and his colleagues used a combination of microscopy and fractal analysis to examine marks on the teeth of members of an ancient human ancestor species and found that what it actually ate does not correspond with the size and shape of its teeth. This finding suggests that structure alone is not enough to predict dietary preferences and that evolutionary adaptation for eating may have been based on scarcity rather than on an animal's regular diet.

"These findings totally run counter to what people have been saying for the last half a century," said Peter Ungar, professor of anthropology in the J. William Fulbright College of Arts and Sciences. "We have to sit back and re-evaluate what we once thought." Ungar and his colleagues Frederick E. Grine of Cambridge University and Stony Brook University and Mark F. Teaford of Johns Hopkins University School of Medicine reported their findings in the PLoS One.

The researchers examined the teeth of Paranthropus boisei, an ancient hominin that lived between 2.3 million and 1.2 million years ago and is known popularly as the "Nutcracker Man" because it has the biggest, flattest cheek teeth and the thickest enamel of any known hominin. Since the first specimen was reported by Mary and Louis Leakey in 1959, scientists have believed that P. boisei fed on nuts and seeds or roots and tubers found on the savannas throughout eastern Africa because the teeth, cranium and mandible appear to be built for chewing and crunching hard objects.



"The morphology suggests what *P. boisei* could eat, but not necessarily what it did eat," Ungar said.

Anthropologists have traditionally inferred the diet of this and other ancient human ancestors by looking at the size and shape of the teeth and jaws. However, by looking at the patterns of microscopic wear on a tooth, scientists can get direct evidence for what these species actually ate.

Ungar and his colleagues used a combination of a scanning confocal microscope, engineering software and scale-sensitive fractal analysis to create a microwear texture analysis of the molars of seven specimens of *P. boisei*. The specimens spanned a time frame of almost a million years and were found in Kenya, Tanzania and Ethiopia. Using these techniques, they were able to create three-dimensional "point clouds" that showed the pits and scratches on the teeth.

The researchers looked at complexity and directionality of wear textures in the teeth they examined. Since food interacts with teeth, it leaves behind telltale signs that can be measured. Hard, brittle foods like nuts and seeds tend to lead to more complex tooth profiles, while tough foods like leaves lead to more parallel scratches, which corresponds with directionality.

They compared the dental microwear profiles of *P. boisei* to the microwear profiles of modern-day primates that eat different types of diets -- grey-cheeked mangabeys and brown capuchins, which eat mostly soft items but fall back on hard nuts or palm fronds, and the mantled howling monkey and silvered leaf monkey, which eat mostly leaves and other tough foods. They also compared the microwear analysis to analyses of teeth from some of the fossil's more contemporary counterparts -- *Australopithecus africanus*, which lived between 3.3 million and 2.3 million years ago, and *Paranthropus robustus*, which lived between 2 million and 1.5 million years ago.

The *P. boisei* teeth had light wear, suggesting that none of the individuals ate extremely hard or tough foods in the days leading up to death. It's a pattern more consistent with modern-day fruit-eating animals than with most modern-day primates. "It looks more like they were eating Jell-o," Ungar said.

This finding, while contradictory to previous speculation on the diet of *P. boisei*, is in line with a paradox that has been documented in fish. Liem's Paradox states that animals may actively avoid eating the very foods they have developed adaptations for when they can find other food sources.

It appears that this paradox may hold true for *P. boisei* and for some modern-day primates as well.

"If you give a gorilla a choice of eating a sugary fruit or a leaf, it will take the fruit every time," Ungar said. "But if you look at a gorilla's skull, its sharp teeth are adapted to consuming tough leaves. They don't eat the leaves unless they have to." This finding represents a fundamental shift in the way researchers look at the diets of these hominins.

"This challenges the fundamental assumptions of why such specializations occur in nature," Ungar said. "It shows that animals can develop an extreme degree of specialization without the specialized object becoming a preferred resource."

This project was funded in part by grants from the National Science Foundation.

Citation: Ungar PS, Grine FE, Teaford MF (2008) Dental Microwear and Diet of the Plio-Pleistocene Hominin *Paranthropus boisei*. PLoS One 3(4): e2044. doi:10.1371/journal.pone.0002044

*Adapted from materials provided by University of Arkansas.*

<http://www.sciencedaily.com:80/releases/2008/04/080429204255.htm>

## Newly Refined Antibody Therapy May Be Potent Treatment For Autoimmune Diseases



*An old, fickle therapy for a variety of autoimmune diseases is getting a makeover, thanks to a decade-long investigation by Rockefeller University researchers. The original treatment, called intravenous immunoglobulin or IVIG, is an amalgam of specific antibodies made from the pooled blood plasma of thousands of healthy donors. (Credit: Image courtesy of Rockefeller University)*

ScienceDaily (Apr. 30, 2008) — An old, fickle therapy for a variety of autoimmune diseases is getting a makeover, thanks to a decade-long investigation by Rockefeller University researchers. The original treatment, called intravenous immunoglobulin or IVIG, is an amalgam of specific antibodies made from the pooled blood plasma of thousands of healthy donors. Physicians have used it both on-label and off in patients with lupus, arthritis, asthma and other immune disorders, to varying degrees of success. But new research shows that understanding how the therapy works at a molecular level can help researchers create a version in the lab that's many times more potent.

Jeffrey Ravetch, Theresa and Eugene M. Lang Professor and head of the Leonard Wagner Laboratory of Molecular Genetics and Immunology, has been interested in IVIG ever since he became aware of its inherent paradox: IgG antibodies, the very class of antibodies that triggers autoimmune diseases, give IVIG its anti-inflammatory properties when pooled from healthy donors. In 2006, Ravetch and his colleagues discovered that this apparent contradiction could be attributed to a single sugar molecule called sialic acid, located at the very tip of some IgG antibodies. When present, the molecule confers anti-inflammatory properties. When absent, the IgG molecules lose their protective abilities and can actually cause inflammation.

Once the scientists had pinned down the molecular mechanism at the source of the contradiction and proved that they could map out a strategy for building a drug with the therapeutic properties of IVIG, they set about creating it. Ravetch, together with his collaborators at the University of New Hampshire and



The Scripps Research Institute, produced an engineered, sialylated IgG molecule that — when given to arthritic mice — was about 30 times more effective than IVIG alone. “This paper provides a clear route for developing an alternative for IVIG, which could be of great benefit to patients with autoimmune diseases,” Ravetch says. The results, reported in the latest issue of *Science*, also describe the precise structural requirements needed to create IgG with protective properties.

Rockefeller has licensed the technology to the biotechnology company Centaurus Pharmaceuticals, which is working to create a product that can be used in clinical trials. Ravetch believes that the resulting drug will have the potential to provide relief to people with a wide range of ailments, including those for whom IVIG just barely scratches the surface. In lupus, for instance, the current preparation has such low activity that the amount required to effect a noticeable difference exceeds the amount that can be realistically derived from the blood supply. “But with the recombinant form,” Ravetch says, “you can make an unlimited, potent supply.”

Journal reference: [Recapitulation of IVIG Anti-Inflammatory Activity with a Recombinant IgG Fc](#). *Science* 320 (5874): 373–376 (April 18, 2008)

*Adapted from materials provided by [Rockefeller University](#).*

<http://www.sciencedaily.com:80/releases/2008/04/080428145012.htm>

## Bison Can Thrive Again, Study Says



*A bison and calf in Yellowstone National Park. (Credit: Julie Larsen Maher/Wildlife Conservation Society)*

ScienceDaily (Apr. 30, 2008) — Bison can repopulate large areas from Alaska to Mexico over the next 100 years provided a series of conservation and restoration measures are taken, according to continental assessment of this iconic species by the Wildlife Conservation Society and other groups.

The assessment was authored by a diverse group of conservationists, scientists, ranchers, and Native Americans/First Nations peoples, and appears in the April issue of the journal *Conservation Biology*.

The authors say that ecological restoration of bison, a keystone species in American natural history, could occur where conservationists and others see potential for large, unfettered landscapes over the next century. The general sites identified in the paper range from grasslands and prairies in the southwestern U.S., to Arctic lowland taiga in Alaska where the sub-species wood bison could once again roam. Large swaths of mountain forests and grasslands are identified as prime locations across Canada and the U.S., while parts of the desert in Mexico could also again support herds that once lived there.

The researchers assessed the restoration potential of these areas by creating a "conservation scorecard" that evaluated the availability of existing habitat, potential for interaction with other native species, such as elk, carnivores, prairie dogs, and grassland birds, and a variety of other factors, including the socio-economic climate of the regions and the potential for cultural re-connection with bison. The higher the score of these factors, the more likely restoration could take place over time.

"The bison is one of the great living symbols of North America," said the paper's lead author, Dr. Eric Sanderson of the Wildlife Conservation Society. "This assessment shows us what is possible; that with hard work and ambitious goals, we can restore this iconic species to a surprising amount of its former range over the next century."





Bison once numbered in the tens of millions but were wiped out by commercial hunting and habitat loss. By 1889 fewer than 1,100 animals survived. In 1905 the American Bison Society (ABS) formed at WCS's Bronx Zoo headquarters and began efforts to re-populate reserves on the Great Plains with animals from the zoo's herd and other sources (bison continue to be exhibited at the Bronx Zoo and Queens Zoo). Of the estimated 500,000 bison existing today, 20,000 are considered wild; the rest live on private ranches.

"The bison is an important part of the heritage of not only the Wildlife Conservation Society but the United States." said Dr. Steven E. Sanderson, President and CEO of WCS. "One hundred years ago, through our efforts and the efforts of others, the bison was saved from extinction. We are now looking 100 years from now, because we believe there is an ecological future for the bison in the North American landscape."

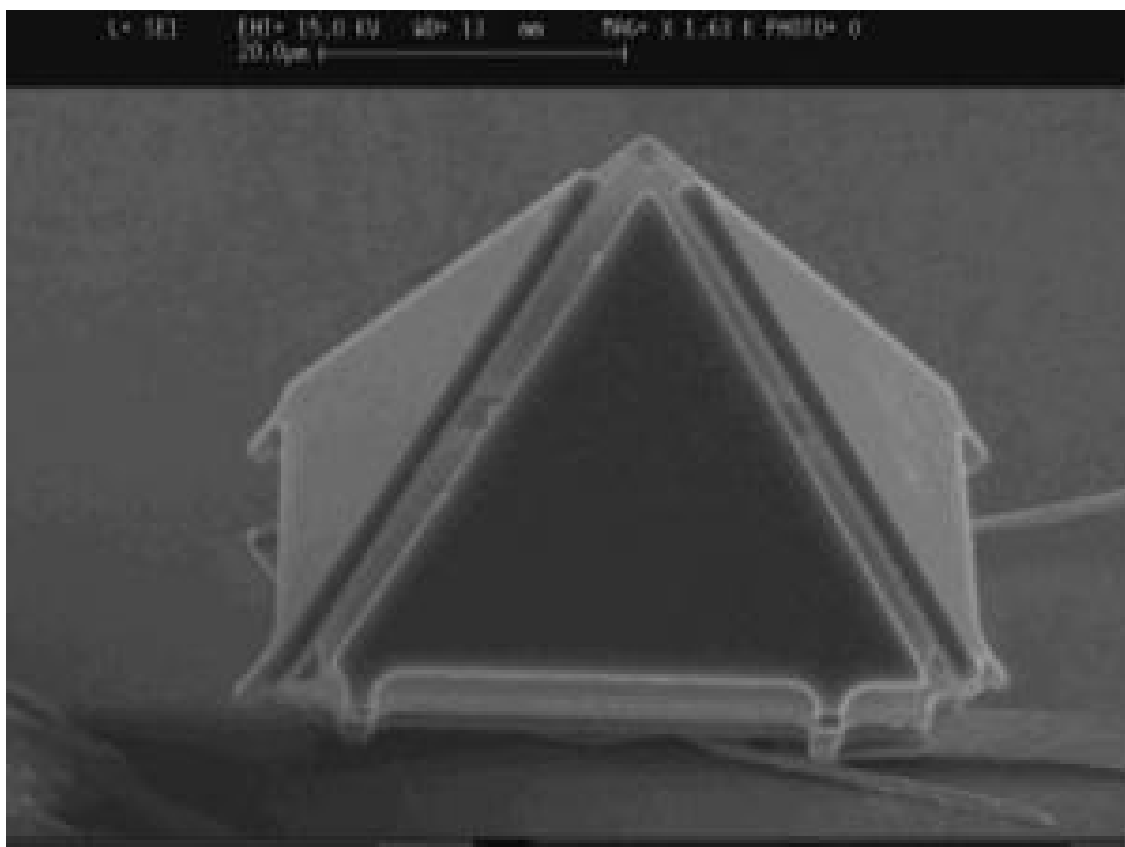
The assessment is part of a long-term effort launched in 2006 by the new American Bison Society, led by WCS and including other conservation groups, Native Americans, agencies and private ranchers, to restore the "ecological role" of the bison. According to the groups, ecological restoration would occur when large herds of plains and wood bison can move freely across extensive landscapes within major habitats of their historic ranges. It would also include bison interacting with the fullest possible set of other native species, as well as inspiring, sustaining and connecting human cultures.

Ecological restoration will likely take a century, says WCS, and will only be realized through collaboration with a broad range of public, private and indigenous partners.

*Adapted from materials provided by Wildlife Conservation Society, via EurekAlert!, a service of AAAS.*

<http://www.sciencedaily.com:80/releases/2008/04/080429130927.htm>

## Micro-origami: Micrometer-scale 'Voxels' Folded Up For Drug Delivery



*Not exactly Pharaoh size: 30 micrometer five-sided pyramid. (Credit: Image courtesy of University of Southern California)*

ScienceDaily (Apr. 30, 2008) — Researchers at the USC Information Sciences Institute have demonstrated a way to manufacture miniscule containers that might be used to deliver precise micro- or even nano- quantities of drugs.

According to ISI project leader Peter Will, who is a research professor in the Viterbi School of Engineering, the new technique, described in a paper in the *Journal of Micromechanics and Microengineering*, is a two-step process.

Part one is the creation of flat patterns, origami, of exactly the fold up shapes familiar to kindergarten children making paper pyramids, cubes or other solids, except that these are as small as 30 micrometers on a side. (1 inch = 25,400 micrometers)

Instead of paper, the USC researchers created the patterns in polysilicon sitting on top of a thin film of gold, using a well- established commercial silicon wafer process called PolyMUMPs. The next step was clearing the polysilicon off the hinge areas by etching.

When the blanks were later electrocoated with permalloy to make them magnetic, the photomask used left hinge areas uncoated, to make sure they were the places that folded.

Then the folding had to be accomplished. First the researchers bent the hinges by application of magnetic force. Then water pressure and capillary forces generated by submerging the tiny blanks in water, and drying them off did the final folding into shape.



The experiments spend considerable time comparing various methods of controlling the closure effects of water drying with simple flaps designed to close over each other to form "envelops," the directing water from different directions sequence the closing. Varying the time of trying could produce tighter seams.

"Our experiments show" says the paper, that "the combination of partial folding of structures by magnetic actuation and liquid closure to bring the structures to their final closed state is an extremely promising technique for mass production of large arrays of micrometer size ...voxels. Furthermore, we believe that future optimization of the voxel hinge geometry and composition should allow for extensions of our work to" much smaller voxels.

The Voxel team - consisting of Will, professor of chemistry Bruce Koel (who has since gone to Lehigh University), former post-doctoral researcher Alejandro Bugacov and former grad student (now graduate) Rob Gagler folded a number of different shapes, including four- and five-sided pyramids, pentagonal 'lotus' shapes, and also simple square plates that folded over each other to make flat mini- envelopes.

Will (right) has been pursuing the idea of creating voxels for many years, "way back to my days in HP labs, when I was working in Medical and Chemical applications." The USC team designed the chips using MEMSPRO CAD software; the actual chip fabrication was done in France.

"The experimental work was done on campus," said Will, "since ISI doesn't have a wet lab."

The National Science Foundation supported the research, under an exploratory research grant. The paper is "Voxels: volume-enclosing microstructures," J. Micromech. Microeng. 18 (2008) 055025.

*Adapted from materials provided by University of Southern California.*

<http://www.sciencedaily.com:80/releases/2008/04/080429130931.htm>

## Restoration Of A Tropical Rain Forest Ecosystem Successful On Small-scale



*Half a century after most of Costa Rica's rain forests were cut down, researchers from the Boyce Thompson Institute for Plant Sciences (BTI) on the Cornell campus are attempting what many thought was impossible -- restoring a tropical rain forest ecosystem. (Credit: Image courtesy of Cornell University)*

ScienceDaily (Apr. 30, 2008) — Half a century after most of Costa Rica's rain forests were cut down, researchers from the Boyce Thompson Institute for Plant Sciences (BTI) on the Cornell campus are attempting what many thought was impossible -- restoring a tropical rain forest ecosystem.

When the researchers planted worn-out cattle pastures in Costa Rica with a sampling of local trees in the early 1990s, native species of plants began to move in and flourish, raising the hope that destroyed rain forests could one day be replaced.

Ten years after the tree plantings, Cornell graduate student Jackeline Salazar counted the species of plants that took up residence in the shade of the new planted areas. She found remarkably high numbers of species -- more than 100 in each plot. And many of the new arrivals were also to be found in nearby remnants of the original forests.

"By restoring forests we hope not only to be improving the native forests, but we are helping to control erosion and helping the quality of life of the local people," said Carl Leopold, the William H. Crocker Scientist Emeritus at BTI. He pointed out that drinking water becomes more readily available when forests thrive because tree roots act as a sort of sponge, favoring rainwater seepage and preventing water running off hills and draining away.



Fully rescuing a rain forest may take hundreds of years, but Leopold, whose findings are published with Salazar in the March 2008 issue of *Ecological Restoration*, said the study's results are promising. "I'm surprised," he said. "We're getting impressive growth rates in the new forest trees."

The project started when Leopold partnered with colleagues at the Ithaca-based Tropical Forestry Initiative; in 1993 they began by planting mixtures of trees on worn-out pasture land. For 50 years the soil had been compacted under countless hooves, and its nutrients washed away. When it rained, Leopold said, the red soil appeared to bleed from the hillsides.

The group chose local rain forest trees for planting, collecting seeds from native trees in the community. "You can't buy [these] seeds," Leopold said. "So we passed the word around among our farmer neighbors." When a farmer reported a tree producing seeds, Leopold and his wife would ride out on horses to collect the seeds before hungry monkeys beat them to it.

The group planted mixtures of local tree species, trimming away the pasture grasses until the trees could take hold. This was the opposite of what commercial companies have done for decades, planting entire fields with a single type of tree to harvest for wood or paper pulp.

The trees the group planted were fast-growing, sun-loving species. After just five years, those first trees formed a canopy of leaves that shaded out the grasses underneath.

"One of the really amazing things is that our fast-growing tree species are averaging 2 meters of growth per year," Leopold said. He believes that microscopic soil fungi called mycorrhizae can take much of the credit. They have apparently survived in the soil and form a symbiosis with tree roots. Research at Cornell and BTI, he said, has shown that without mycorrhizae, many plants can't grow well.

The promising results of the project mean that mixed-species plantings can help jump-start a complex rain forest. Local farmers who use the same approach will reduce erosion of their land, while creating a forest that can be harvested sustainably, a few trees at a time.

*Adapted from materials provided by Cornell University.*

<http://www.sciencedaily.com:80/releases/2008/04/080428133928.htm>

## Inexpensive Roof Vent Could Prevent Billions Of Dollars In Wind Damage



*Engineering science and mechanics doctoral student Yihong Yang installs the V2T prototype roof vent in the Virginia Tech stability wind tunnel. (Credit: Photo by Michael Miller, VTIP)*

ScienceDaily (Apr. 30, 2008) — Hurricanes often lift the roofs off buildings and expose them to havoc and damaging conditions, even after the worst of the wind has passed. A local roofer, Virginia Tech faculty members from architecture and engineering, and a graduate student have devised an inexpensive vent that can reduce roof uplift on buildings during high winds, even a hurricane.

Low-sloped roof buildings around Wytheville, Va., where Virginia Tech alumnus Chuck Johnson and his brother, Pat Johnson, operate a roofing business, have sprouted foot-high plastic structures that look vaguely like alien technology – a flying saucer connected by three narrow columns to a dome.

Chuck Johnson, an irresistible pitchman, has also persuaded Travel Centers of America in South Carolina, the Gaston County government complex in North Carolina, a Nestlé's distribution center in Tel Aviv, and VTKnowledgeWorks in the Virginia Tech Corporate Research Center to use the revolutionary Venturi Vent Technology (V2T™), designed for membrane roofing systems.

Hurricane Andrew (August 24, 1992) resulted in \$26 billion worth of damage. It was the first big event that created changes in the roofing industry, said Johnson. "Now, so many fasteners are required that roofing is very expensive and the integrity of the deck is compromised," he said. "Plus, if you ever have to take the roof off, you have to take it off in pieces and recycling the material is impossible. It's all very labor intensive."

But the V2T system could revolutionize the way roofing is done, Johnson said. "We are using physics instead of mechanical fasteners or adhesives. The harder the wind blows, the better it works."

The physics is the Venturi effect. You know – wind forced through an opening speeds up. Covered porches create a breeze. Winds blow harder through mountain passes and between city buildings. Cars at



any speed split the air, so when you crack the car window to get rid of cigarette smoke, the lower pressure outside sucks the smoke out the window.

Sitting at their kitchen table about six years ago, the Johnson brothers asked, “What if we could split the wind blowing over a roof and create a vacuum to suck the roof down instead of up?”

The result was V2T.

V2T splits the airflow, speeding up the wind that is forced through the vent (between the upper saucer and the lower dome), which drops the pressure and creates a vacuum. The saucer has a hole on the bottom and the columns are tubes from the saucer to the dome and the underside of the roof membrane. The wind pressure draws the air out of the saucer and from under the membrane, pulling the membrane down tight against the substrate. “The pressure being created under the membrane is lower than the uplifting pressure of the wind over the roof. The result is a low pressure condition that prevents the uplift and detachment of the roof membrane,” said Jim Jones, associate professor of architecture at Virginia Tech.

The Johnsons took their idea to Virginia’s Center for Innovative Technology (CIT), which referred them to Jones. “Their concept was a tube shaped vent that would rotate to catch the wind,” Jones said.

He saw that keeping up with changing wind direction could be a problem and decided to investigate whether the Venturi concept could be applied to an omni-directional design “so it wouldn’t matter which way the wind came from.”

Jones and his graduate student, Elizabeth Grant, started exploring the geometry of a pyramidal base with an inverted pyramid on top – like an hour-glass with a space in the middle for the wind to pass through. They presented that idea to Demetri Telionis, the Frank Maher Professor of Engineering Science and Mechanics, an aerodynamics expert, who suggested a similar but rounded shape – the dome and saucer. “Once we decided on the geometry, the fine tuning became Grant’s thesis. She created a model with an adjustable distance between the dome and bowl and began wind-tunnel tests.”

Grant was already an experienced architect and designer whose credentials included affiliation with the Roof Consultants Institute. She made the project her master’s degree research with the other members of the design team as her thesis advisors.

With funding from the CIT and the Johnsons’ company, Acrylife, the team designed and built several prototypes – with different shapes, distances, and connecting columns, with the goal of enhancing the vacuum -- and tested them in Virginia Tech’s stability wind tunnel, where winds can reach 150 miles an hour, and in the NASA full scale wind tunnel at Langley Air Force Base. These tests demonstrated the ability of the vent to generate low pressure that could be used to counter the uplifting forces from high winds.

The team figured out how to take a force of nature and harness it, using geometry and physics, “So the very force that could destroy a building is used to save it,” Grant said.

The height of the dome was partially dictated by consideration of rain and snow levels on a roof, Jones said. “The hole was placed in the bottom of the bowl to avoid admitting water. So with the hole in the top unit, the columns had to be hollow.”

Jones said at least two questions remain to be answered. One is concerned with the spacing of the units. Although Johnson has a degree of confidence in the current spacing, he agrees. “It is important to verify this with testing in order to take out the guess work. We need to establish a set of rules that define where the units should be placed for each different roof type.”



Jones suggests, “To maximize the economic benefits of the V2T, spacing should depend on a variety of factors, such as building geometry, parapet wall height, and infiltration rate through the roof deck; and therefore some further study is needed.”

The second question, Jones said, is “What happens to the vacuum that holds the membrane down if there are cracks in the substrate or sub roof? We have scheduled a series of wind tunnel tests to better understand this situation as we begin to develop design guidelines for the system,” Jones said.

UL testing is also scheduled for June.

Meanwhile, also with an introduction and funding from the CIT, Acrysoft is developing hardware and software to provide real-time monitoring of the vent. A sensor board developed in conjunction with the Space Alliance Technology Outreach Program will measure the pressures created in the vent and the forces on and under the roof membrane, said Mark Howard, a partner at Acrysoft. “This information has not been available.”

He said such data is critical to engineers. “They want this data before their company invests in a roof system,” said Howard. The sensor, along with cameras, will substantiate initial performance and provide long-term monitoring, “for example, in case there is a tear during an AC repair or some other activity on the roof,” Howard said.

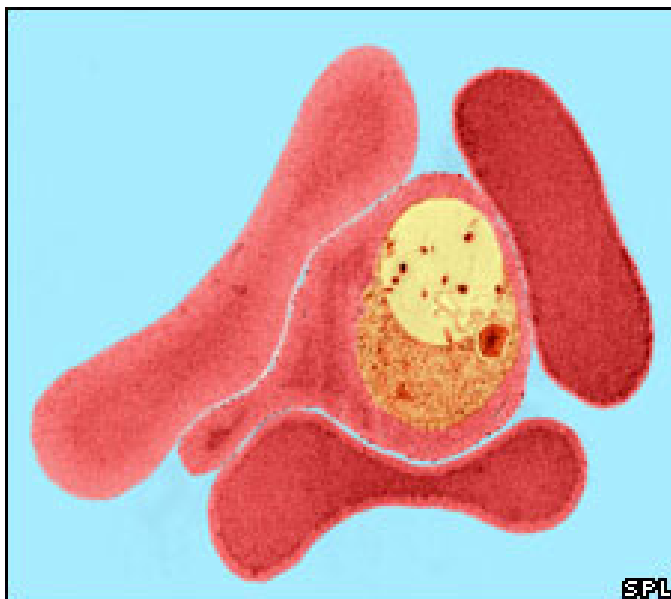
Although the Johnson brothers have been putting their systems on roofs, it would be better if it were provided to roofers by the manufacturers of the roof membrane materials as part of a complete roof assembly, said Chuck Johnson.

*Adapted from materials provided by Virginia Tech.*

[http://www.sciencedaily.com /releases/2008/04/080428141822.htm](http://www.sciencedaily.com/releases/2008/04/080428141822.htm)



### **Warming 'affecting poor children'**



### **Climate change is already affecting the prospects for children in the world's poorer countries, according to Unicef.**

The UN children's agency says that increases in floods, droughts and insect-borne disease will all affect health, education and welfare.

While richer societies can adjust, it says in a new report, poorer ones do not have the resources.

It is asking western governments to reduce greenhouse gas emissions swiftly and provide money to help poor nations.

"Those who have contributed least to climate change - the world's poorest children - are suffering the most," said David Bull, executive director of Unicef UK.

### **Rich countries' responsibility for the bulk of past emissions demands that we give our strong support**

Sir Nicholas Stern

"If the world does not act now to mitigate and adapt to the risks and realities of climate change, we will seriously hamper efforts to reach the Millennium Development Goals (MDGs) by 2015 and sustain development progress thereafter."

The report is launched in the UK 10 years to the day after the government signed the Kyoto Protocol on reducing greenhouse gas emissions.

### **Missed goals**

The eight Millennium Goals include such targets as eradicating extreme poverty and hunger, reducing infant mortality rates by two-thirds and halting the spread of diseases such as HIV and malaria.



Progress has been good in some parts of the world, but earlier this month the World Bank warned some targets were likely to be missed; sub-Saharan Africa was likely to miss all eight, the Bank said.

Unicef concludes that climate change is already making achieving them more difficult.

#### **THE MILLENNIUM GOALS**

- 1: Eradicate extreme poverty and hunger
- 2: Achieve universal primary education
- 3: Promote gender equality and empower women
- 4: Reduce child mortality
- 5: Improve maternal health
- 6: Combat HIV/AIDS, malaria, and other diseases
- 7: Ensure environmental sustainability
- 8: Develop a global partnership for development

Agricultural productivity is forecast to decline markedly in most of Africa, South Asia and Latin America; countries such as Zambia are already seeing a significant reduction in rainfall; the threat of waterborne diseases such as cholera is projected to increase.

The 2006 Stern Review concluded that climate change could increase annual child deaths in sub-Saharan Africa and South Asia by up to 160,000 through GDP loss alone.

"All the essential effects we are seeing now are associated with a temperature increase since 1850 of less than 1C," Sir Nicholas Stern writes in a foreword to the Unicef report.

"Past actions and the likely trend of emissions... imply that another 1-2C will be hard to avoid.

"Rich countries' responsibility for the bulk of past emissions demands that we give our strong support."

The UN climate convention contains funds designed to help the poorest countries adapt to climate impacts, but critics say the sums are far too small to make a difference.

Story from BBC NEWS:

<http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/7372137.stm>

Published: 2008/04/29 00:44:32 GMT



## Nature's carbon balance confirmed

Scientists have found new evidence that the Earth's natural feedback mechanism regulated carbon dioxide levels for hundreds of thousands of years.



But they say humans are now emitting CO<sub>2</sub> so fast that the planet's natural balancing mechanism cannot keep up.

The researchers, writing in the journal *Nature Geoscience*, say their findings confirm a long-believed theory.

Carbon spewed out by volcanoes is removed from the air by rock weathering and transported to the ocean floor.

Using evidence from an Antarctic ice core, the team calculated that over a period of 610,000 years the long-term change in atmospheric CO<sub>2</sub> concentration was just 22 parts per million (ppm), although there were larger fluctuations associated with the transitions between glacial and interglacial conditions.

### **This suggests a natural thermostat which helps maintain climate stability**

Richard Zeebe

By comparison, two centuries of human industry have raised levels by about 100 ppm - a speed of rise about 14,000 times faster.

"These long term cycles are way too slow to protect us from the effect of (anthropogenic) greenhouse gases," said Richard Zeebe from the University of Hawaii in Honolulu.

"They will not help us with our current CO<sub>2</sub> problem. Right now, we have put the system entirely out of equilibrium."

## Deep level



Scientists have long believed that the Earth's climate was stabilised by a natural carbon thermostat.

In their model, carbon released into the atmosphere, primarily by volcanoes, is slowly removed through the weathering of mountains, washed downhill into oceans, and finally buried in deep sea sediments.

"A lot of people had tried to refute this hypothesis, but our study provides the first direct evidence (that it is correct)," said Dr Zeebe.

He studied levels of CO<sub>2</sub> recorded in air bubbles trapped in a 3km ice core drilled from an Antarctic region called Dome Concordia (Dome C).

Data from the ice core, drilled by the European Project for Ice Coring in Antarctica (Epica), was first published in 2005.

But rather than focusing on the peaks and troughs of CO<sub>2</sub> - as other researchers have done - this group looked at the long term trend, and compared the ice core data with records of carbonate saturation in the deep sea for the last six glacial cycles.

"It is remarkable how exact the balance is between the carbon input from volcanoes and the output from rock weathering," said Dr Zeebe.

"This suggests a natural thermostat which helps maintain climate stability."

The delicately balanced carbon thermostat has been a key factor in allowing liquid water, and life, to remain on Earth, he said.

"If it weren't for these feedbacks, the Earth would look very different today."

Story from BBC NEWS:

<http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/7363600.stm>

Published: 2008/04/28 15:19:54 GMT

## Nurses warn over emergency care

**Patients in A&E units are being put at risk because people are being admitted to inappropriate wards so hospitals can hit the four-hour target, nurses say.**



A poll of 500 emergency nurses found three-quarters were regularly pressured to admit patients to the wrong wards sometimes for as little as 30 minutes.

Patients needing surgery had been put on gynaecology or orthopaedic wards, said the Royal College of Nursing.

But the government said the target had improved patient care.

### **It is not good for care and causes confusion**

Peter Carter

Royal College of Nursing

The college is calling on ministers to relax the target so that only 95% of patients need to be seen within four hours to give health staff more flexibility.

The target was originally set at 100% in 2000, but was reduced to 98% three years later amid concerns, particularly from doctors, that it was too restrictive.

But the college's survey suggested staff were still being forced to move patients around the system.

### **Staging post**

Speaking at the nurses' annual conference in Bournemouth, RCN general secretary Peter Carter said patients were put in wards that were "a bit like a staging post".

As well as gynaecology and orthopaedic wards, he said this could include medical assessment units, generally used for triaging, and observation units.



"The point is that because of pressure from the government and this four-hour target is seen as such a critical issue, people are going to inappropriate places. It is not good for care and causes confusion."

Rabina Tindale, a senior lead A&E nurse and head of the RCN's emergency care association, said it was worse at peak times.

She said she had heard of stroke patients being admitted to medical assessment unit.

"Although the nurses can care for them, they do not have that specialist experience."

She added the RCN was now calling for a 3% reduction in the target to take the "pressure out of the system".

She added: "Although nothing catastrophic has been reported, we don't want to wait for that to happen."

Lib Dem health spokesman Norman Lamb said: "Targets must not be allowed to override the common sense and good judgement of staff."

"If the government insists on prioritising central targets at all cost, it risks alienating staff and compromising patient care."

But a Department of Health spokeswoman said the target had been a force for good.

"Long waits at A&E, like those we used to see, are unacceptable to the public."

"It is a huge tribute to NHS staff that the vast majority of hospitals now regularly meet the target."

And she added patient care was paramount and that was why the target was not for 100% of patients.

### **Staff shortages**

Meanwhile, in his opening speech at the conference, Mr Carter said nurses were being hampered in doing their job, citing staff shortages, mixed-sex wards and high rates of bed occupancy.

"There are just too many obstacles to delivering the kind of care you want to as skilled professionals."

He also called for a debate about the issue of presumed consent for organ donation.

The government has indicated it is in favour of swapping the opting in system currently in operation for opting out in a bid to boost the number of organ donors - although no decision has yet been taken.

It came after nurses at the conference rejected a motion which called for the RCN to oppose attempts to introduce presumed consent.

Story from BBC NEWS:  
<http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/7371329.stm>

Published: 2008/04/28 23:46:17 GMT



## Tree-lined streets 'cut asthma'



### **Children who live in tree-lined streets have lower rates of asthma, a New York-based study suggests.**

Columbia University researchers found that asthma rates among children aged four and five fell by 25% for every extra 343 trees per square kilometre.

They believe more trees may aid air quality or simply encourage children to play outside, although they say the true reason for the finding is unclear.

The study appears in the *Journal of Epidemiology and Community Health*.

US rates of childhood asthma soared 50% between 1980 and 2000, with particularly high rates in poor, urban communities.

In New York City, asthma is the leading cause of admission to hospital among children under 15.

The researchers found the city had an average of 613 street trees per square kilometre, and 9% of young children had asthma.

### **This is a positive first step into a new area of research linking the environment and asthma**

Leanne Male  
Asthma UK

The link between numbers of trees and asthma cases held true even after taking into account sources of pollution, levels of affluence and population density, the researchers said.

However, once these factors were taken into account, the number of trees in a street did not appear to have any impact on the number of children whose asthma was so severe that they required hospital treatment.

### **Exposure theory**



Some experts believe that children who are exposed to few microbes in early life are at an increased risk of asthma because their immune systems do not get the practice they need at fighting infection.

Therefore, if a tree-lined street encourages outside play, it might help reduce the risk of asthma by maximising the odds that children will be exposed to microbes.

However, trees are also a source of pollen, which may potentially exacerbate asthma symptoms in vulnerable children.

Lead researcher Dr Gina Lovasi admitted the effect, if any, of trees was far from clear.

She said: "There may be something else healthful about the areas that had more trees.

"For example, trees could be more abundant in areas that are well maintained in other ways."

Leanne Male, assistant director of research at the charity Asthma UK, said: "Previous research looking at the influence of the environment on levels of asthma has focused on negative aspects, such as pollution and chemical exposure.

"This innovative report is the first to look specifically at the potentially beneficial effects of trees in urban areas and raises some interesting issues.

"However, there are a number of other factors that have not been considered, for example whether the families involved have pets.

"Despite the need for further work, this is a positive first step into a new area of research linking the environment and asthma."

New York City is planning to plant 1 million extra trees by 2017.

Story from BBC NEWS:

<http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/7374078.stm>

Published: 2008/05/01 00:18:38 GMT



## Schools could monitor well-being

**Schools in England could be made to keep records of pupils' drug use and obesity under plans being considered.**



A discussion document seen by The Guardian details how 18 aspects of pupils' lives, including the incidence of pregnancies, could be monitored.

The idea was first set out in the Children's Plan published by the government last year.

Head teachers, now being consulted over the plans, said it would be "absolutely wrong to dump this agenda on schools".

Schools have had a duty to promote the broader well being of their pupils since 2006 - for instance by encouraging them to exercise and eat healthily.

In the Children's Plan, ministers said England's schools' inspectorate Ofsted should judge schools on pupil well-being as well as exam results, exclusion rates and other existing factors.

The discussion document gives more details, suggesting bullying, obesity, entrance to the youth justice system, and destinations on leaving schools could also be included, according to The Guardian.

Ofsted could begin monitoring such areas as early as next year.

### 'Death knell'

John Dunford, general secretary of the Association of School and College Leaders (ASCL), said: "Children only spend a small proportion of their lives at school. It's absolutely wrong to dump this agenda on schools.



"Schools have a part to play in reducing obesity and in reducing teenage pregnancy but that has to be part of a whole area strategy. It's not something you can measure each school against."

The Association of Teachers and Lecturers says teachers should not be held responsible for all aspects of pupils' lives.

**Schools have a crucial role to play in children's lives but it is not down to them to solve issues in wider society alone - and we have never said it was**

Jim Knight, Schools Minister

Mary Bousted, the union's general secretary, said: "If the government adds more targets over which schools have very little control that would sound the death knell for teachers and school leaders.

"While it's important for schools to have good joined-up working with a range of other services, they can't be held responsible for everything."

Schools Minister Jim Knight said Ofsted had been evaluating schools' contribution to children's well-being since 2005.

"Schools have a crucial role to play in children's lives but it is not down to them to solve issues in wider society alone - and we have never said it was. We want teachers to be able to focus on teaching.

"In the Children's Plan we announced that we want to do more to ensure schools get the support needed for pupils by bringing integrated services into schools. It is about schools being able to tap into expert outside help.

"It will simply focus inspections on how children's lives are improving and we are discussing with schools, unions and local authorities how we can make sure this can be assessed more fairly, recognised and properly rewarded."

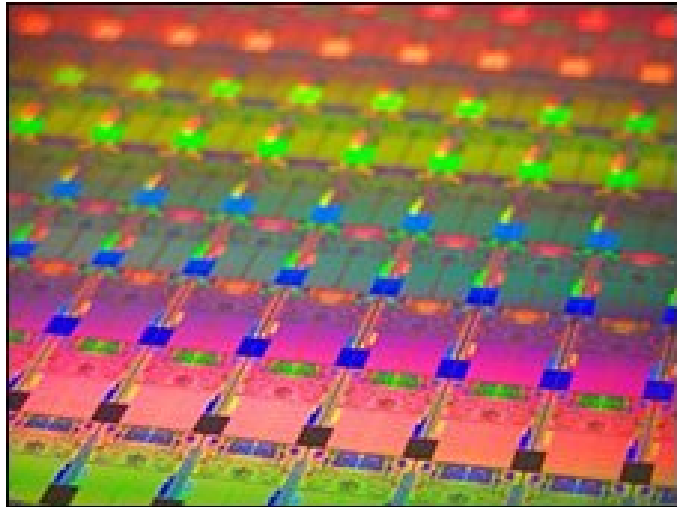
Story from BBC NEWS:

[http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk\\_news/education/7376046.stm](http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk_news/education/7376046.stm)

Published: 2008/04/30 16:41:33 GMT



## Electronics' 'missing link' found



Hewlett-Packard's Stan Williams helped develop 'memristors'

**Details of an entirely new kind of electronic device, which could make chips smaller and far more efficient, have been outlined by scientists.**

The new components, described by scientists at Hewlett-Packard, are known as "memristors".

The devices were proposed 40 years ago but have only recently been fabricated, the team wrote in the journal *Nature*.

They have already been used to build novel transistors - tiny switches that are the building blocks of all chips.

"Now we have this type of device we have a broader palette with which to paint our circuits," Professor Stan Williams, one of the team, told the BBC last year.

### **Total recall**

Memristors were first proposed in 1971 by Professor Leon Chua, a scientist at the University of California, Berkeley.

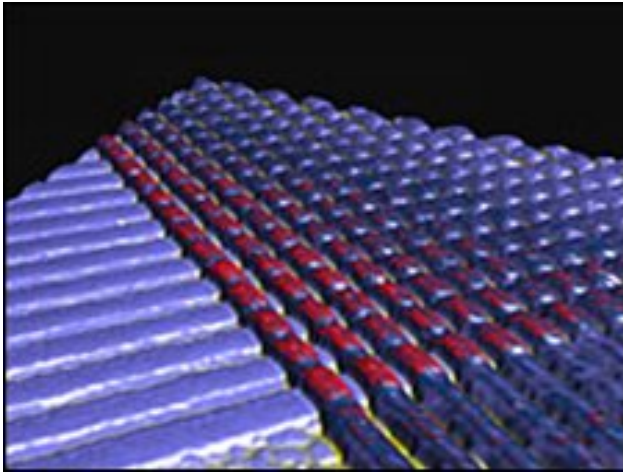
They are the "fourth" basic building block of circuits, after capacitors, resistors and inductors.

"I never thought I'd live long enough to see this happen," Professor Chua told the Associated Press.

"I'm thrilled because it's almost like vindication. Something I did is not just in my imagination, it's fundamental."

The memristors are so called because they have the ability to "remember" the amount of charge that has flowed through them after the power has been switched off.

This could allow researchers to build new kinds of computer memory that would not require powering up.



Today, most PCs use dynamic random access memory (DRAM) which loses data when the power is turned off.

But a computer built with memristors could allow PCs that start up instantly, laptops that retain sessions after the battery dies, or mobile phones that can last for weeks without needing a charge.

"If you turn on your computer it will come up instantly where it was when you turned it off," Professor Williams told Reuters.

"That is a very interesting potential

application, and one that is very realistic."

### 'Industry anathema'

Professor Williams and his team have already shown that by putting two memristors together - a configuration called a crossbar latch - it could do the job of a transistor.

"A crossbar latch has the type of functionality you want from a transistor but it's working with very different physics," he explained.

Intriguingly, these devices can also be made much smaller than a conventional transistor.

"And as they get smaller they get better," he said.

As a result, the new devices could play a key part in the future of the electronics industry, as it relentlessly pursues Moore's Law.

This industry axiom, first stated by Gordon Moore, co-founder of chip-maker Intel, states that the number of transistors it is possible to squeeze in to a chip for a fixed cost doubles every two years.

However, according to some, it may be some time before the device is widely used.

"Even to consider an alternative to the transistor is anathema to many device engineers, and the memristor concept will have a steep slope to climb towards acceptance," wrote Drs James Tour and Tao Heare of Rice University, Houston, in an accompanying article in Nature.

They said that some in the electronics industry would only accept the use of memristors "after the demonstration of a well-functioning, large-scale array of these densely packed devices".

"When that happens, the race towards smaller devices will proceed at full steam."

Story from BBC NEWS:

<http://news.bbc.co.uk/go/pr/fr/-/2/hi/technology/7377063.stm>

Published: 2008/05/01 10:14:49 GMT

## Delusions 'haunt' sick children

**One in three children admitted to intensive care will suffer powerful and frightening hallucinations which stay with them, say UK researchers.**



A study of 100 children found those who had hallucinations were more likely to show signs of post-traumatic stress disorder three months later.

The "delusional memories" may be linked to medication, such as painkillers and sedatives, the researchers said.

Some children may need psychological support after discharge, they added.

Although previous research has looked into adult memories of intensive care, very little has been carried out in relation to children.

**It isn't clear, because the children are very ill, whether it's to do with the severity of their illness or the drugs used to treat it**

Dr Reinout Mildner  
Birmingham Children's Hospital

Study leader, Gillian Colville, a consultant clinical psychologist at St George's Hospital in London, said she had seen a considerable number of children in distress over the years.

She interviewed children aged 7 to 17 who had been treated at Great Ormond Street Hospital and found two-thirds could remember something factual about their time in intensive care although it was generally vague.

But 32% of children reported delusional memories, including hallucinations, the study in American Journal of Respiratory and Critical Care Medicine found.

It was these children who had significantly higher scores on post-traumatic stress screening tests.

**Vivid**

Ms Colville said the children remembered the delusions vividly.

"The hallucinations children reported were overwhelmingly disturbing and frightening, similar to those reported by adult intensive care patients and heroin addicts going through withdrawal."

Dr Christine Pierce, consultant in paediatric intensive care at Great Ormond Street, said some children were having hallucinations about balloons in the shape of cartoon characters tied to the end of the bed and others reported having scorpions and spiders crawling on them.

"You're handing back a 'healthy child' but they are having difficulties going back to school or having nightmares.

"We now say to parents the hallucinations are a possibility and [the children] could have problems after they leave the unit and, if they do, please let us know and we can get them help.

"We bring in the psychologist very quickly now."

Dr Reinout Mildner, consultant in paediatric intensive care at Birmingham Children's Hospital, said the results definitely fit in with what he saw in the ward.

"It isn't clear, because the children are very ill, whether it's to do with the severity of their illness or the drugs used to treat it."

He said children may be very vocal about their hallucinations or withdraw into their own world - which can be very hard to recognise.

"It can be hard to follow children up so we need to make parents and other teams in the hospital aware of it."

Dr Bruce Taylor, honorary secretary of the Intensive Care Society, said: "What you do in intensive care, to give people a chance of survival, is not what nature intended so they have to be heavily sedated.

"Survival rates in paediatric intensive care are pretty good so it's a price that has to be paid and children are very good at bouncing back from these things."

Story from BBC NEWS:

<http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/7377371.stm>

Published: 2008/05/02 00:57:11 GMT

### **Teachers 'should have more say'**

**Teachers should decide what is taught in schools and not ministers or employers, academics argue.**



Those in the classroom are best-placed to judge which topics will bring alive key subjects for the children of today, an Oxford University academic says.

They should act as mediators of the knowledge of previous generations for the youngsters of 2008, the Nuffield Review of 14-19 education says.

A centrally-prescribed, handed-down curriculum limits learning, it adds.

#### **'Rethink'**

Professor Richard Pring, who leads the review, says successful teaching depended on the teacher "knowing where young people were" in terms of their understanding and the social and cultural context in which they live.

But teachers should be careful not to focus too closely on the concerns of young people so that the value of what is to be learned is lost, he argues.

"We have to be responsive to young people but we have to have something to offer young people - otherwise teachers are reduced to some sort of childminder," he says.

He adds that given the massive changes to society and problems of youngsters disengaging with their education, there was now a need to review the very nature of the national curriculum.

The Nuffield Review suggested that the government's current overhaul of 14-19 education and the introduction of Diplomas provided a good opportunity for a rethink.

#### **'Continual dialogue'**



But Prof Pring warned that teachers must be central players in the Diplomas' development.

A Department for Children, Schools and Families spokesman said there had always been opportunities for teachers to contribute to the development of the National Curriculum, mainly through schools' ongoing contacts with the Qualifications and Curriculum Authority (QCA).

"The QCA is in continual dialogue with schools through its advisory groups, and through annual subject teacher questionnaires.

"It also has an ongoing relationship with a number of volunteer schools through its co-development network for curriculum innovation."

Story from BBC NEWS:

[http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk\\_news/education/7378293.stm](http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk_news/education/7378293.stm)

Published: 2008/05/01 16:22:36 GMT

**Spam reaches 30-year anniversary**





**Spam - the scourge of every e-mail inbox - celebrates its 30th anniversary this weekend.**



The first recognisable e-mail marketing message was sent on 3 May, 1978 to 400 people on behalf of DEC - a now-defunct computer-maker.

The message was sent via Arpanet - the internet's forerunner - and won its sender much criticism from recipients.

Thirty years on, spam has grown into an underground industry that sends out billions of messages every day.

Statistics gathered by the FBI suggest that 75% of net scams snare people through junk e-mail. In 2007 these cons netted criminals more than \$239m (£121m).

Statistics suggest that more than 80%-85% of all e-mail is spam or junk and more than 100 billion spam messages are sent every day.

The majority of these messages are being sent via hijacked home computers that have been compromised by a computer virus.

### **Quick complaint**

The sender of the first junk e-mail message was Gary Thuerk and it was sent to advertise new additions to DEC's family of System-20 minicomputers.

It invited the recipients, all of whom were on Arpanet and lived on the west coast of the US, to go to one of two presentations showing off the capabilities of the System-20.



Reaction to the message was swift, with complaints reportedly coming from the US Defense Communications Agency, which oversaw Arpanet, and took Mr Thuerk's boss to task about it.

Despite Mr Thuerk's pioneering spam it took many years for unsolicited commercial e-mail to become a nuisance.

It took until 1993 before it won the name of spam - a name bestowed on it by Joel Furr - an administrator on the Usenet chat system.

Mr Furr reputedly got his inspiration for the name from a Monty Python sketch set in a restaurant whose menu heavily featured the processed meat.

The sketch ended with everyone in the restaurant, encouraged by a troupe of chanting Vikings, shouting: "Spam. Spam. Spam. Spam. Spam."

April 1994 saw another pioneering moment in the history of spam when immigration lawyers Canter and Siegel sent a commercial spam message to more than 6,000 Usenet discussion groups.

The Canter and Siegel e-mail is widely seen as the moment when the commercialisation of the net began and opened the floodgates that led to the deluge of spam seen today.

Since those days spam has grown to be a nuisance and is now used by many hi-tech crime gangs as the vehicle for a variety of scams and cons.

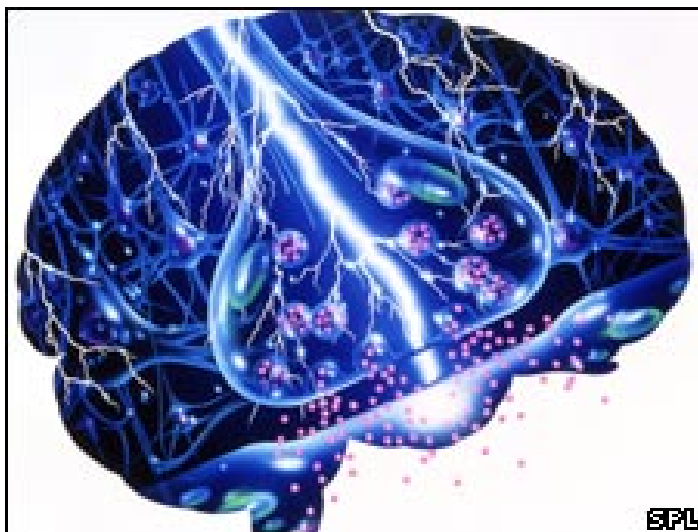
"Spam is a burden on all of us," said Graham Cluley, senior technology consultant at Sophos. "What's worse is that a lot of spam is deliberately malicious today, aiming to steal your bank account information or install malware."

Story from BBC NEWS:  
<http://news.bbc.co.uk/go/pr/fr/-/2/hi/technology/7380788.stm>

Published: 2008/05/02 23:44:12 GMT

## Diet treatment call for epilepsy

**A special high-fat diet helps to control fits in children with epilepsy, a UK trial suggests.**



The number of seizures fell by a third in children on the "ketogenic" diet, where previously they had suffered fits every day despite medication.

The diet alters the body's metabolism by mimicking the effects of starvation, the researchers reported in the *Lancet Neurology*.

The researchers called for the diet to be more widely available on the NHS.

It is the first trial comparing the diet with routine care, even though it has been around since the 1920s.

Children are given a tailored diet very high in fat, low in carbohydrate and with controlled amounts of protein.

**The parents say the first two weeks are quite difficult but then it becomes much easier because you can make foods in bulk and it especially helps if you can see the benefits from it**

Professor Helen Cross

It is not exactly clear how it works but it seems that ketones, produced from the breakdown of fat, help to alleviate seizures.

A total of 145 children aged between two and 16 who had failed to respond to treatment with at least two anti-epileptic drugs took part in the study.

Half started the diet immediately and half waited for three months.

The number of seizures in the children on the diet fell to two-thirds of what they had been, but remained unchanged in those who had not yet started the diet, the researchers reported.

Five children in the diet group saw a seizure reduction of more than 90%.



However, there were some side-effects including constipation, vomiting, lack of energy and hunger.

### **Availability**

Professor Helen Cross, study leader and consultant in neurology at Great Ormond Street Hospital in London, said the diet had been around for a long time but had fallen out of favour because it was thought to be too difficult to stick to.

"The parents say the first two weeks are quite difficult, but then it becomes much easier because you can make foods in bulk and it especially helps if you can see the benefits from it," she said.

"We have to be sensible about it, in this study we had children who had complex epilepsy.

"If your epilepsy is easily controlled on one medication then I wouldn't advocate the diet, but if at least two drugs have failed then it should be considered."

She said national guidelines recommend the diet as a treatment option, but a shortage of dieticians meant it was often unavailable.

A spokesperson for Epilepsy Action said: "The results of this trial add valuable information to what is already known about the diet, presenting evidence that it works for some children with drug-resistant epilepsy.

"In addition to this, however, we also recognise that the ketogenic diet is not without its side-effects, and that the risks and benefits should be considered before prescribing, as with drug treatment."

She said the results would hopefully encourage wider inclusion of the diet in the management of children with drug-resistant epilepsy.

Story from BBC NEWS:

<http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/7378178.stm>

Published: 2008/05/02 23:17:59 GMT

## Teachers 'struggle with grammar'

**English teachers who went to school when grammar was not on the curriculum struggle to teach it, research shows.**



A review of international studies on the effective teaching of complex writing says there is a need to improve the teachers' own skills.

The work was done by Exeter University for the Department for Children, Schools and Families in England.

The department said its professional standards demanded that teachers have a secure knowledge of their subject.

The study concludes: "For English teachers, who themselves attended schools when grammar was not part of the English curriculum, there is a significant issue of lack of assurance in grammatical subject knowledge, leading to difficulties in addressing grammar meaningfully in the writing classroom.

"In particular, effective teaching requires a secure understanding not simply of grammatical terminology, but of applied linguistics and an awareness of the ways in which grammatical constructions are used in different texts for different communicative purposes."

### **Discrete skills**

Among the studies that were examined, a recent one investigated the difficulties faced by trainee teachers when they taught writing.

Being new to teaching, they were trying to understand the processes involved in becoming a writer.

But they were also having to focus on different kinds of writing as a way to meet objectives laid down in curriculum documents.

So they tended to see writing as a process of acquiring discrete skills, such as "writing descriptions" or "using complex sentences".

They tended to get bogged down in the mechanics and neglected the writers' ideas or engagement with the reader.

Another study described a "significant knowledge gap" in terms of teachers' pedagogical knowledge.

One piece of research on the linguistic subject knowledge that teachers and trainee teachers bring to their teaching of writing found "a persistent theme in teachers' attitudes to grammar is hostility to anything that makes formal structure the central object of study".

This claimed few teachers brought any specialist knowledge of grammar to their training from their degree studies but did bring "many anxieties and misconceptions around 'grammar'."

### **'Lack of confidence'**

It added that "it is the height of folly to send them into schools where they will have to teach grammar without making time during their training for them to get to grips with the subject".

A study of the linguistic subject knowledge of trainee teachers in the UK found that two thirds reported a lack of confidence about grammar.

"They felt that their greatest need was in using grammar to support EAL [English as an additional language] and knowing when and how to teach it.

"Trainees reported that they embarked on topics and then stumbled into difficulties. Even simple topics seemed to become complex."

A spokeswoman for the schools department said: "We know that grammar is important and that is why it is a compulsory part of the national curriculum.

"In particular, primary teachers focus heavily on sentence construction, grammar and syntax as part of teaching reading and writing, for which there are specific national curriculum targets.

"Our professional standards for teachers demand that they must have a secure knowledge of their subjects and curriculum areas to enable them to teach effectively across the age range they trained for. And Ofsted has said that we have the best trained teachers ever."

*Effective Ways of Teaching Complex Expression in Writing - a Literature Review of Evidence from the Secondary School Phase by Debra Myhill, Ros Fisher, Susan Jones, Helen Lines and Alun Hicks, University of Exeter*

Story from BBC NEWS:

[http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk\\_news/education/7380202.stm](http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk_news/education/7380202.stm)

Published: 2008/05/02 15:26:56 GMT



## Scourge of the corporate pirates

The artist's enemy is obscurity, not piracy, says novelist and Web activist Cory Doctorow

BRIAN BETHUNE | April 23, 2008 |

"No, no, Marcus is more aspirational than autobiographical," laughs Cory Doctorow about the 17-year-old hero of his newest science fiction novel, *Little Brother* (Fenn). Principled, literate, brave and, above all, technologically savvy, Marcus puts pebbles in his shoes to fool his school's "gait recognition" software, chats with friends on an IMParanoid messaging program, and takes on the Department of Homeland Security's Orwellian surveillance system in the name of liberty. "He's the teen we all would have liked to have been," says Doctorow, 36, who nevertheless bristles at the thought that Marcus is too unrealistic: "People have said, 'C'mon, no teenager reads Jane Jacobs'; I read Jane Jacobs when I was a teenager!" You don't have to talk long with Doctorow to be unsurprised by that statement. The child of Trotskyite schoolteachers, arrested twice for civil disobedience before he was 18, as conversant with Dickens and Twain as with the hot-button issues of commerce, culture and technological innovation, Doctorow would get the benefit of the doubt if he claimed to have read Plato at five. At his parents' Toronto home, while his mother, Roz, looks after his 11-week-old daughter, Poesy, Doctorow talks about how he is as much cyberspace activist and blogger as author. (His blog, *BoingBoing.net*, is one of the Internet's most influential tech commentary sites.) "I'm a professional Cory Doctorow: I write novels and I write blog entries, but all of it is in service of taking note of the way technology is changing society and seeking to affect that."

For a decade Doctorow has campaigned, if not quite in Marcus's underground hacker mode, for copyright liberalization and against governments' attempts to monitor the Internet, as well as corporate plans to maintain vast databases of cybertraffic. The question to ask about any intellectual property rights regime, he says, is "does it encourage or discourage involvement, art-making, information-sharing?" In his opinion, the current system only serves corporate dinosaurs, "big dying institutions." They use copyright to try to regulate technology, to criminalize (or at least turn a profit on) all the peer-to-peer file sharing that is the "Internet's greatest achievement: lowering the cost of mass collaboration, the barriers to innovation." It adds up to an eternal and futile attempt to throttle the mechanisms of change. Long before sheet-music publishers fought record makers (who later battled radio stations, who complained of TV and so on), monks who produced manuscripts were damning the printing press as the devil's engine. What's particularly galling for Doctorow is that "yesterday's pirate is today's admiral — Sony, the VCR pirate, denounced by moviemakers a generation ago, has come full circle to sue Napster's successors." Of course, institutions — especially wealthy ones — want to live on, even past their times, Doctorow acknowledges. "I used to be a bartender, and there was always somebody who didn't want the night to end. But there comes a time when you have to put the chairs up on the table." Doctorow puts his own wallet where his mouth is. His fiction comes out in conventional book form, but he also posts it for free download on his personal website, *Craphound.com*. That leads to the one question everyone wants to ask Doctorow: how do you make a living? "Most of my income comes from advertising on *BoingBoing*, but the free releases have helped me financially by increasing my profile. *Little Brother* has brought me my largest advances yet. Everyone who has tried posting books online has done it again. That's a pretty good indicator it works. An artist's enemy is obscurity, not piracy." It's not as though, Doctorow adds, copyright makes much money for many content providers beyond a "very loud" handful of the "very rich and very famous." The old regime, Doctorow argues, is fated to pass, whatever might replace it. "The most interesting discussion bubbling up now is how do we get stable institutions when, at any moment, new technologies can render them obsolete." The response for the author is the same as it is for his character. In *Little Brother*, whenever Marcus is faced with unpalatable answers, he subverts the question. "Stability is overrated," Doctorow says. "Our cultural institutions, whose purpose — arguably the purpose of all institutions ever — is to facilitate collective action, to do things one individual can't, will now be created on an ad hoc basis, to pass away when not needed." Time to put those chairs up on the table.

[http://www.macleans.ca/culture/entertainment/article.jsp?content=20080423\\_94758\\_94758](http://www.macleans.ca/culture/entertainment/article.jsp?content=20080423_94758_94758)





## Once it was only God, now we're all 'creators', says Rupert Christiansen

'Creativity' is a word much bandied about in our babble of culturespeak. Like "community", it has a warm glow around it, and we rarely give it much further thought.

However, to mark the centenary of Freud's essay "Creative Writers and Day Dreaming", a series of lectures curated by Michael Arditti at the Freud Museum under the title "The Creative Journey" is about to consider it more closely in conversations with "creators", including Jonathan Miller and Fay Weldon.

Freud was fascinated by the unconscious nature of creativity, and the writer's inability to give an adequate account of the source of his inspiration.

The nearest psychoanalysis could come to an explanation is that the creative impulse is "a continuation of, and a substitute for, what was once the play of childhood." This is not altogether convincing, as Freud himself acknowledged.

For the best part of 1,500 years, the Christian West considered God the only creator. What we would classify as a creative artist would in the Middle Ages rank only as a skilful imitator of life, someone who held a mirror up to nature. Shakespeare often equates "creation" with delusion and dream.

Only in the 18th century, with the decline of belief in an omnipotent deity and the rise of the more humanist philosophies of the Enlightenment, does the adjective "creative" appear in the language, associated with the word "artist".

The Romantics took this even further, claiming that the artist was divinely inspired and therefore part of a spiritual elite. The contrast between the painting, poetry or music that these artists created out of their imaginations and the mindless mass-production of mechanical manufacture went on to become a cornerstone of 19th-century thought.

It's a concept that remains with us today: painters, novelists and composers are still regarded with a penumbra of awe, and none of us ever pauses to think that even the humblest nut and bolt was at some point the product of human creativity, too.

In other respects, the idea of "creativity" has been thoroughly democratised, extending way beyond poetry, art and music. Haute cuisine and couture are creative. Every evening-class syllabus offers courses in creative flower-arranging, creative homemaking.

Businesses hold creative-thinking seminars, universities teach creative writing, ministers make speeches puffing our "creative industries". Even the splodges and squiggles that children daub in primary school are deemed creative.

One could even say that the idea of creativity has become thoroughly debased; very few of us are creators in the pure sense of using our imaginations to make something significantly new, let alone useful. The medievalists were largely right: most of what gets called creative activity is more accurately described as copying or reflecting existing elements.

Meanwhile, as Richard Sennett's recently published book *The Craftsman* points out, the idea of craft has been subtly demoted to that of a sub-hippie fad or weekend hobby.

"Skill is a capacity that we develop and most people have it in them to become good craftsmen," says Sennett, but somehow this sounds like a drab matter of following inherited conventions and learnt rules - the successful throwing of a pot or the building of a wall doesn't have the glamour that surrounds a "created" novel or painting.





Yet "craft" is more essential to human existence than art: it is craft that keeps you alive on a desert island, it is craft that makes shelter habitable and food edible, it is craft that mends the boiler, car and computer.

Art, almost by definition, doesn't function: it may decorate our lives and enlarge our minds and provide spiritual pleasure and enlightenment, but does it really deserve the sacred status that its association with "creativity" gives it?

As a society, we have arrived at a false valuation of the creative artist, with wildly excessive rewards for some of those who write novels or paint portraits (£20 million for a Lucien Freud?) and an education system that expends disproportionate time and energy encouraging and sponsoring people to become, in effect, day-dreamers.

Instead, we should be investing more respect and money in the acquisition of ordinary skills and practical crafts that would allow us to take more control of our own lives. "The hand is the window to the mind," said the philosopher Kant, and the same relationship should be acknowledged as the hub of creativity, too.

Lectures until Oct 23. Details: 020 7435 2002

<http://www.telegraph.co.uk/arts/main.jhtml?xml=/arts/2008/04/30/bacolumn130.xml>

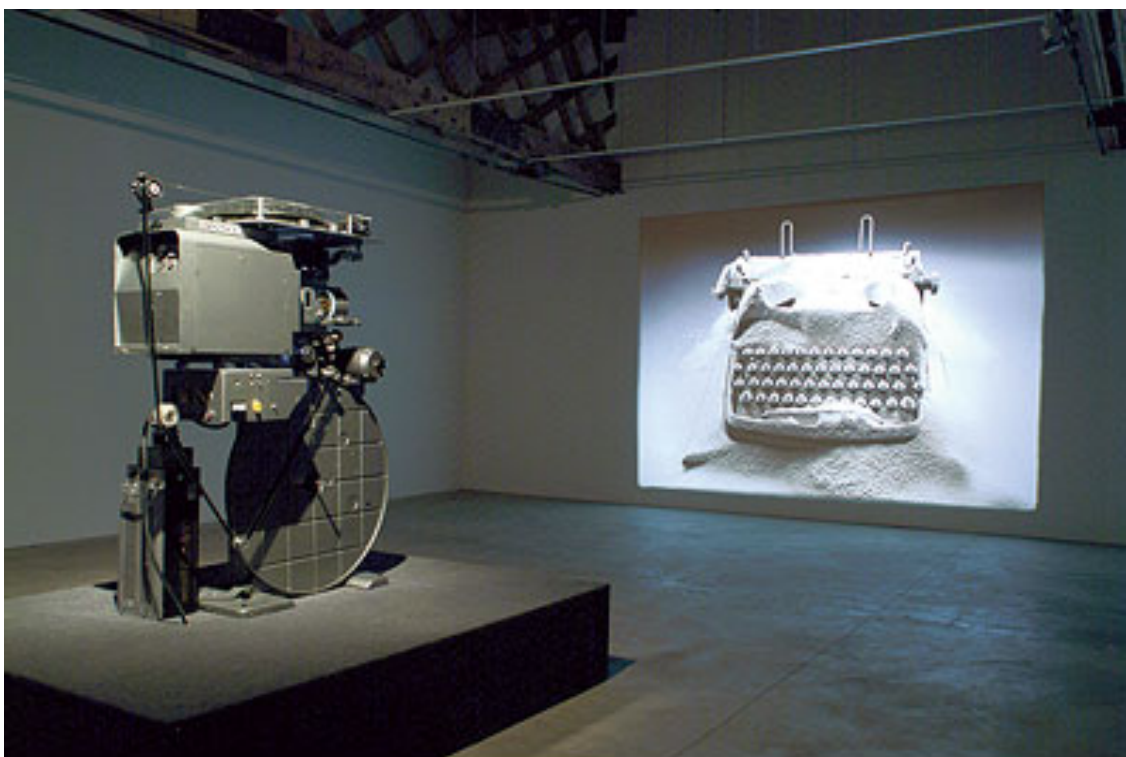
## The Moving Image and Its Impact on Contemporary Art

By **RICHARD B. WOODWARD**

April 30, 2008; Page D9

Washington

Some dubious assertions underlie "The Cinema Effect: Illusion, Reality and the Moving Image" at the Hirshhorn Museum and Sculpture Garden. The museum's chief curator, Kerry Brougher, who co-organized the show, believes seductive electronic images have blurred fantasy and reality to such an extent in our lives that "life itself is just like a movie."



Donald Young Gallery, Chicago.

"Rheinmetall/Victoria 8" is a salute to antiquated technology.

This cliché is itself seductive but no more true now than in 1990 when it was a tenet of the Whitney Museum's show, "Image World." The diffusion of information technology hasn't revolutionized everything. Existence is always a negotiation between fact from fiction. Long before MGM or the Internet, Cervantes and Flaubert were writing about characters who acted as if "life itself were just like a book." Most of us can still tell where one ends and the other begins.

Luckily, most of the artists in this ambitious and enjoyable survey of contemporary video and film don't appear to be guided by the bromides of postmodern art theory. Indeed, this international sample of works from the last 50-odd years has defied efforts to separate artistic practice into two distinct installations.

The first half, "Dreams," up now through May 11, includes 21 pieces grouped around the exploration of the moving image as a trance state; the second half, "Realisms," from June 19-Sept. 7, will present 20 works keyed more around social issues, including the nature of representation.

This oppositional format is based on an idea proposed by the French critic André Bazin. Over half a century ago he wrote that cinema could be divided into two parts that reflected two sources from the

French silent era: the entertainments of Georges Méliès, director of silent features about voyages to the moon and other escapist comedies that often relied on special effects; and the documentaries of the Lumière brothers, who turned their cameras on the mundane realities of 1890s Paris, brief scenes of anonymous citizens leaving factories or descending from trains.

## THE CINEMA EFFECT

### Hirshhorn Museum and Sculpture Garden

Part 1: Through May 11

Part 2: June 19 through Sept. 7

Such a split, as even Bazin noted, is only provisional. The moving image is so slippery that spillover between the oneiric and the naturalistic is inevitable. As the director Jean-Luc Godard once puckishly observed, Méliès now seems like a historian from the age of space travel, whereas steam engines and men in hats in the Lumière films now look like science fiction. "The Cinema Effect" smartly illustrates how the two categories have become in many ways, like the hemispheres of the brain, permeable and complementary.

The darkened rooms in "Dreams" are full of works that as easily have earned a place in "Realisms." Take, for example, Andy Warhol's "Sleep" from 1963 in which a camera studies in static close-up a man sleeping. A film so literal that few can endure it (the original was eight hours but is edited here to a merciful 100 minutes), it shatters accepted notions of the documentary. With nothing to look at except the face of someone dozing, one enters a meditative state, acutely aware of breath rhythms, skin pores and film grain.

Harun Farocki, a Czech filmmaker living in Berlin, makes deliberate fun of Bazin's categories. "Workers Leaving the Factory in Eleven Decades" from 1995 selects 11 scenes from as many feature films, everything from Chaplin's "City Lights" to Antonioni's "Red Desert." Playing on a row of 11 monitors in the second floor lobby, it demonstrates how staged attempts at realism quickly become badly dated. But Mr. Farocki is making a subtler point as well. These snippets of film are stamped by the innovations in cameras, lens film stock that created them, making these pieces of fiction documents from the history of cinema technology.

Mr. Brougher's catalog essay cites the early and continuous relationship between the amusement park and cinema. Thomas Edison's crews recorded the novel spectacle of outdoor electric lighting at Luna Park in Coney Island in 1906. And Hollywood producers since the early days of Walt Disney have wrung extra money out of their films by turning them into theme park sensations. Many of this summer's blockbusters are designed to take the viewer on a thrill ride.

Several artists here play with these ingredients. In "Geisterbahn" from 1999, Darren Almond has mounted a camera on the front of a



In Douglas Gordon's "Off Screen," the viewer's shadow is integrated into a work about the creation of images in cinema.

Douglas Gordon and  
Fundacao Centro Cultural de Belem, Lisbon



carriage through an old fun house. But the place is run down, with pop-up skeletons that weren't scary even in 1955, and Mr. Almond slackens our passage to a crawl.

What's really spooky, he implies, is how quickly the recent past has decayed and is receding from us.

It is notable that "Geisterbahn" and several other works are in black-and-white. Almost extinct in feature film-making, monochrome survives in the art world for its ability to abstract reality and slow it down. But video artists have earned a deserved reputation for slowing things down a little too much. Few viewers these days have the time for inscrutable performances lasting hours without a narrative pay-off. Mr. Brougher and his co-curator Kelly Gordon are to be congratulated for their sure-handed blend of works differing in length and sophistication.

Several pieces can be experienced in a few moments or lingered over as long as you wish. I walked past Douglas Gordon's "Off Screen" from 1998 without sensing at first it was part of the show. You step through a curtain, tinted red by a video projector, into a dark room where light from another projector blinds you for a moment. Your shadow on the curtain, visible to the next person waiting to enter the room, is thus integrated into an elemental work about the creation of images in cinema.

Rodney Graham's "Rheinmetall/Victoria 8" from 2003 takes more patience. Images of a '30s-era German typewriter slowly disappearing under falling white powder are generated by a huge, noisy '50s-era Italian film projector. This nostalgic salute to antiquated technology also contrasts the immateriality of cinematic pictures with the hulking physicality of the industry responsible for movies. We can hear the film spooling through the shutter, the spiked gears not so different from the tracks on a roller coaster.

"The Cinema Effect" is off to an auspicious start with "Dreams."

The essays in the catalog, published by D.A.P., are only mildly blighted with art jargon. I can only hope that "Realisms" will deliver this much provocative entertainment.

*Mr. Woodward is an arts critic in New York.*

**URL for this article:**

<http://online.wsj.com/article/SB120952033973554955.html>

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## A Closer Look at Minorities in Engineering

In confronting the “gathering storm” of declining competitiveness in the global marketplace, policy makers and business leaders often point to the importance of foreign students and international education in boosting both research and the American work force. A new report released on Thursday argues instead that the solution lies at home, “untapped,” waiting for the nation to wake up to the “quiet crisis” of minority underrepresentation in engineering-related fields.

“We find ourselves at this moment in history with the number of engineering graduates at one of its lowest levels of the past 20 years, and yet a time when the demand for young people prepared to work in America’s high-technology industries has never been higher,” wrote John Brooks Slaughter, president and CEO of the National Action Council for Minorities in Engineering, which sponsored the report through a grant from the Motorola Foundation.

The report, whose title, “Confronting the ‘New’ American Dilemma,” refers to a landmark 1944 study on race relations by the Swedish economist Gunnar Myrdal, argues that the mismatch between the demands of science and engineering fields and the graduates produced by American colleges and universities must be addressed by boosting the number of underrepresented minorities pursuing those degrees.

While the percentage and number of such minorities (defined as African Americans, Latinos/as and American Indians/Alaska Natives) earning degrees in science, technology, mathematics and engineering — or STEM — fields has generally increased over the years, the report notes the daunting obstacles that confront policy makers and educators seeking to increase the diversity of graduate students, professors and scientists in private industry who have made it through the pipeline. According to NACME, only a fraction of underrepresented minorities graduate high school “eligible” to seriously pursue engineering at the college level, a reality the report dubs “the 4 percent problem.”

In 2002, according to the report, 28,000 out of about 690,000 minority students who graduated from high school that year had taken enough required math and science courses to qualify them for a college program in engineering. And of that pool, only 17,000 enrolled in engineering programs as freshmen, compared with 107,000 first-year students at such institutions. “That same year,” the report states, “4,136 Latinos, 2,982 African Americans, and 308 American Indians received baccalaureate degrees in engineering out of a total of 60,639 minority graduates” — just over 12 percent combined out of the total minority graduation pool, including Asian Americans and other groups.

The report itself is part of a broader campaign by the engineering association to promote wide-ranging policy reforms in education, from K-12 to graduate school. The organization envisions a broad-based partnership between government, business and education leaders to expand access, boost funding and support diversity programs for underrepresented minorities.

Among the report’s “calls to action,” for example, are strengthening STEM education early on in school and improving guidance counselors’ “knowledge of STEM careers and college programs and have them send the message to students that STEM careers pay in terms of salary, prestige, and challenge.” It also targets financial aid and affirmative action programs, and calls for “policies to totally transform the education system to emphasize active, hands-on, project-based learning rather than lecture and rote memorization.”

That might be a reference to the educational systems of some Asian countries that send students to American colleges and graduate programs in STEM fields. At a panel announcing the report’s release on Capitol Hill on Thursday, several participants seemed to pit the success of underrepresented minorities against that of foreign students studying at American colleges, with the implicit suggestion that lawmakers should focus instead on the latent potential of African American, Latino and Native American students. “I think it’s a smokescreen,” said Lisa M. Frehill, the executive director of the Commission on Professionals in Science and Technology, which conducted the research for the report, referring to the willingness of colleges to accept foreign students as compared to the educational attainment of underrepresented minorities.



Most of the data come from various government agencies, including the Census Bureau and the [National Center for Education Statistics](#). To take a 2005 snapshot illustrating the dilemmas confronting educators, the report provides the exact number of minority graduates at each degree level. To African-American females, there were 1,074 engineering bachelor's degrees awarded that year, compared with 2,111 for males. Females were awarded 282 master's degrees in engineering compared to 592 for males, while 26 black females earned Ph.D.s in engineering, compared with 74 black males.

For Latinos, the numbers are similar: 1,155 bachelor's degrees awarded to women and 3,459 to men; 315 master's degrees to women and 837 to men; at the doctoral level, 28 women earned their degrees and 70 men. The numbers for American Indians and Alaska Natives remain in the single digits at the Ph.D. level, with degrees awarded to eight males and a single female. Those numbers are not available in the report for 2006 because of [a new policy](#) that withholds some data on minority doctorates for privacy reasons.

Some other statistics uncovered in the report:

The number of engineering degrees as a proportion of all bachelor's degrees awarded declined from 1995 to 2005 for all ethnic groups except for American Indians and Alaska Natives. For African Americans, that proportion declined to 2.5 percent from 3.3 percent of all degrees, while for Latinos it declined to 4.2 percent — about the level for non-Hispanic whites — from 5.5 percent in 1995.

At the associate degree level, the percentage of engineering degrees earned by African Americans rose to over 10 percent from about 4 percent between 1991 and 2005. That percentage increased from 6 percent to 9 percent over the same period at the bachelor's degree level.

The top institutions awarding engineering bachelor's degrees to African Americans are all historically black universities: North Carolina A&T State University, Tennessee State University, Prairie View A&M University, Florida A&M University and Morgan State University.

The gap between white and black educational attainment has narrowed over the years, “but not disappeared,” according to the report. In 2004, 17.6 percent of African Americans and 30.6 percent of non-Hispanic whites held a bachelor's degree or higher.

So far, the report is not available online, but [supplementary materials](#) have been posted at the Commission on Professionals in Science and Technology's Web site.

— Andy Guess

*The original story and user comments can be viewed online at  
<http://insidehighered.com/news/2008/05/02/nacme>.*



### Med Schools' Expected Enrollment Growth

With expected growth at existing schools and a collection of new ones likely on the way, the country's first-year medical school enrollment is projected to grow 21 percent over a 10-year period ending in 2012, according to a [survey](#) released by the Association of American Medical Colleges.

That would mean a collective incoming class of 19,900 students four years from now. By comparison, the survey counted 16,448 first-year students in 2002-3, its baseline year.

Two years ago, concerned about a future physician shortage, the AAMC recommended a 30 percent increase in first-year U.S. medical school enrollment from 2002 to 2015. The report notes that projecting the enrollment data out beyond 2012 using average forecasted increases for existing schools and proposed enrollment figures for the proposed schools, the targeted 30 percent growth would be reached by 2017.

"We're encouraged by the expected growth in medical school enrollment," said Edward Salsberg, director of the association's Center for Workforce Studies, which conducted the survey. "It's clearly a significant change from earlier decades, when there was no growth."

The survey relied primarily on self-reported data provided by 115 M.D.-granting U.S. medical institutions in fall 2007. More than 86 percent of existing schools that participated in the annual survey said they have already expanded the number of first-year students or plan to do so within the next five years.

According to the survey, first-year enrollment in these schools would increase by 2,635 students, or 16 percent, by 2012. This growth would push the average class size at existing medical schools from 132 students in 2002 to 152 students by 2012.

Public institutions are projected to supply 1,821 of these new enrollment slots, while 814 are expected to come from private colleges.

Additionally, at least nine institutions have taken the first step toward medical school accreditation, with some already under development, according to the Liaison Committee on Medical Education, which accredits medical education programs leading to a M.D. degree. Few new schools have emerged in recent decades.

Based on future enrollment figures, the AAMC estimates that nearly 800 first-year students would attend these new programs in 2012-3.

### Planned increase in first-year enrollment by institution type and region (existing schools only)

	Baseline Enrollment (2002-3)	Planned Increase (2012-3)	Percentage Increase From Baseline
<b>Institution</b>			
<b>Type</b>			
Private	6,607	814	12.3%
Public	9,881	1,821	18.4
<b>Region</b>			
Central	4,497	548	12.2
Northeast	5,021	480	9.6
South	5,129	1,208	23.6



West	1,841	399	21.7
<b>All Schools</b>	16,488	2,635	16

Source: Association of American Medical Colleges

Of the existing campuses, far more said they planned to expand, or already have, at their main campus, rather than adding a new regional or branch campus. According to the report, the vast majority of respondents said they planned to target minority groups who are “currently underrepresented in medicine,” and focus on programs that provide primary care services for rural and urban underserved communities.

When asked about barriers to expansion, those surveyed listed common growth concerns, such as capacity of existing clinical sites to train more students, ability to add science and clinical faculty, and ability to fund the programs.

According to the survey, nearly half of the campuses have already built new teaching space or reconfigured existing space to accommodate the growth. Roughly 40 have added new clinical training sites, and 27 schools say they’ve hired new faculty as a direct result of their expansion plans.

Salsberg said that because medical school applications have risen over the last several years, he hasn’t heard concerns from institutions about having an adequate pool of candidates to fill the new slots.

Randolph Canterbury, senior associate dean for education at the University of Virginia’s School of Medicine, said his concerns have more to do with classroom and lab space, as well as having adequate clinical educators across all disciplines.

“Increasing the class by one is trivial in the lecture hall or even in a small group learning situation, but that person has to have the clinical experience as well, and that involves one-on-one training,” he said.

Virginia several years ago increased its class size from 139 to 142 students but hasn’t changed that number in recent years. Canterbury said school officials decided that as of now they don’t have the classroom size or lab facilities necessary to support further growth. A new building scheduled for completion in 2010 could accommodate 18 more students, and Canterbury said officials will look at growing slowly once it opens.

He said that while each school has to do its own growth analysis, “it’s clear that the physician shortage will get much worse before it gets better.”

Patrick Duff, associate dean of students at the University of Florida’s College of Medicine, says the national growth is “extremely positive” for the field.

Like Virginia, Florida in recent years increased first-year class size from 115 to 130 students. For now, Duff said, that’s the ceiling. He cited classroom and lab space — but not dearth of clinical faculty — as the primary reasons for maintaining the current enrollment. Florida is awaiting approval of a new building that could allow that number to grow.

— Elia Powers

*The original story and user comments can be viewed online at <http://insidehighered.com/news/2008/05/02/med>.*



## One for the Money, Two for the Show: Gerd Leonhard and Music 2.0

By Molly Sheridan

Published: April 30, 2008

The future is here, as they say, and boy is it messy. If you are a creator of content, your economic model for making a living probably feels a little twisted around at the moment. Though handwringing is usually in ample supply, there's actually been a lot of action reported in the headlines of late. First, there was the ASCAP-proposed "Bill of Rights for Songwriters and Composers" and accompanying position paper (download [here](#)). Though the point of the document was clarification over forward-moving action, it was consciousness raising in an arguably friendlier guise than the RIAA's courtroom approach to the matter.

But copyright infringement in the digital age will not be stopped, at least not with guilt trips, so some new options need to be placed on the table before we lose any more time and money. Hypebot has a stellar round up of recent action [available for your review](#), and this week in *Slate*, [Reihan Salam outlines](#) what could be a promising solution or a troubling "music tax" in the quest for new profit schemes.



Also out on the net is Gerd Leonhard's *Music 2.0* (download [here](#)). He asserts that the technology is already in place that would allow us to let go of policing copies and instead track music usage in such a way that the public could access "music like water" while also allowing artists to be precisely compensated based on the usage of their work. This would admittedly dramatically shift our economic model, but his thinking fits quite comfortably with the changes we've seen in the past few years. Did he really have the answer? If so, why isn't anyone doing anything like this?

Leonhard studied music at Boston's Berklee College of Music but is based in Switzerland these days. I rang him up, appropriately enough considering the topic, via Skype. Here's what he had to say.

### Questions for Gerd Leonhard, author of *Music 2.0*

- Download a copy of *Music 2.0* [here](#)

**Molly Sheridan:** I'm glad that we got to do this, and it's exciting that we got to do it this way [via Skype] considering the topic of your latest book, *Music 2.0*. It's a collection of your writings in which you suggest strategies for getting the music industry out of some of the economic challenges that it's facing, and one of your key concepts is a proposal that you call "music like water." Could you give us a quick summary of what that means?



**Gerd Leonhard:** First of all, I have to credit David Bowie for coining this phrase; I found it in *The New York Times*—I think it was 2001—where David Bowie said that music will be like water. That sort of stuck to me. Basically what "music like water" means is that music becomes a service rather than a product, and it's something that everybody has—like electricity and like an internet connection, eventually. The internet is becoming a way that we can get music in a way that doesn't feel like we're buying individual copies. What we have to get used to is that the music in this pipeline flows freely, which means that there is a charge for the pipeline, but it's bundled. You know, we don't perceive it to be an actual product thing, like a CD or individual download. So imagine basically a pipeline of music into your PC, into your mobile, your TV, that is just part of the deal. And then, just like water, if you consume more, if you fill up your swimming pool every day, if you want premium products, you pay extra. So it's the very idea of providing music as a service rather than a product.

**MS:** In the entire 200-and-some pages of this book, you make it sound so obvious and so easy to shift to the model, so I'm curious: What is the hang up? Paradoxically, why does it seem so difficult to get this going in the actual music industry?

**GL:** Well, I think that main issue, which I describe in my next book, is about control. You can check out a preview at [endofcontrol.com](http://endofcontrol.com). In the old way of doing things in the music business, there were essentially artists who were under the control of the middlemen—the labels, the publishers, societies, and so on—and the users, who were under the control of retailers and the media. And now because of the internet that whole thing is completely falling apart. So both the artists and the users are becoming empowered to such a degree that the middlemen are suffering from the consequence of course, and in some cases they're benefiting. But they have to re-think their models. No longer do they have the authority or the ability to completely control the environment. This is actually a very good thing—even for them it's a good thing—but in terms of paradigm, the music industry is severely worried that the loss of control will basically kill their profits. And I think this is much more a fear than a fact, like most fears, you know. They are there, but they're not quite real. I mean, obviously you can see that not having total control is a great moneymaker—eBay, Amazon, Google, Skype, that's what they do.

**MS:** I know that a lot of these concerns often come down to issues surrounding copyright law, which has been slow to catch up in these new digital environments. We have people who want to share, remix, the big Creative Commons movement, but the rules of the game aren't keeping pace. Can we wait for them to catch up? You do mention too that major changes are coming from outside [the music industry] that might actually end up effecting this kind of change. How do copyright and digital delivery in this environment fit together for you?

**GL:** Well, I'm very much in favor of copyrighted protection of the creator. I think that it cannot be possible that remuneration for music is completely voluntary in the sense of, you know, if you feel like donating you'll do so; I don't think that's a very successful model for content, even though as a user I would probably like it. But having said that, I think copyright doesn't really help us here. We need a new kind of right that's essentially based on usage. Copyright is a good thing when it's about making copies, but so far all of technology is a giant copy machine—computers, mobile phones, televisions, digital radios. They make copies inadvertently without paying for them. So the idea of copyright doesn't really work here any more in the sense of monetizing. What we need is a new license that basically turns the copying and the using into money. That's what I call a usage right, and we're seeing that happening everywhere. We're seeing the move from the sort of static idea of a copy that gets paid a certain rate to a revenue share and to a usage right which means that I am authorizing agents to give the license for the use of the music, like I always have in the past, for example with radio. I just want to collect a piece of the revenues that the other party is making rather than preventing any kind of copy.

Unfortunately the thing that we're seeing here is that, in principle, I as the music creator have the exclusive right of distribution and copy. In reality, however, that's no longer really feasible. And it sounds like a great loss, but it's not. I cannot really prevent my music from being copied on digital networks. That would be like saying I could prevent airplanes from flying above my house, but that right doesn't really exist



anymore even though it did! I did have the right to refuse it.

The reality is that yes, I can refuse it, nobody will care, everybody will keep on doing it [making copies], and I won't be collecting money. So what I'm saying is I think we should make a switch and say okay, copyright has to be revisited as a term of monetizing. We need a usage right that gets people to be legal users and pay the creators in the process.

**MS:** How far away are we from having a system that could handle that, though? Is that something that the PROs could flip over and do? Do we need a whole new system? Is there some model that we could follow to get that going?

**GL:** Well, there are a couple of things that have to happen for this, but in principle points all the pieces are right here. The technology exists to monitor what people are doing. In terms of recognizing songs and counting them: Shazam, Gracenote, Philips, they all have this fingerprinting and waveform analysis technology—we have all that. That's in place. There is technology that can actually administer royalties, and there are a couple of really cool companies like royaltyshare.com, Bob Kohn's company. That already all exists. So the thing is that the copyright societies that we have now—ASCAP, BMI, and of course the European societies—it would be very hard for them to do a job that's basically mostly built on technology because my hunch is that you'll only get paid 2 or 3 percent of the total to do this job. It's a tech job.

The biggest thing about basically counting what people listen to and then paying for it on a *pro rata* basis is not the technology, it's the privacy issue. In other words, when you have 5 billion people connected on wireless devices, phones, and computers, and then you track all of the use of music—the listening, what they share, what they send—it turns people into sort of glass boxes, right? You know all their profiles, and that can't possibly happen, so the biggest issue there is that, as a user, I want to make sure that I'm not completely transparent to anybody who cares to look at what I listen to. So it has to be anonymized, but those technologies exist as well.

Now that the flat rate is a huge discussion point even with Warner Music in the US and with a Danish telecom called TDC and in China and in India, now these companies are gearing up to provide these services.

**MS:** I was going to say, from your global perspective, this seems in a way kind of un-American and perhaps more at home in a system where, as you have in Europe, they are already paying these kinds of fees for public television and such.

**GL:** Let's be sure: I don't think this is a tax or should be a tax. I think this is a commercial arrangement where the rights holders are saying together that we're giving a collective, voluntary license to anybody who wants one to build their business on our music, because so far people are building their businesses on our music without doing anything because there wasn't anything to use; there was no way to get it ahead of time. This is like starting a radio station and not knowing what you're going to be paying for the music. So now that the whole world is moving onto the web and my grandmother is now using eBay, we just can't ignore this issue.

The global perspective here is that people in India and China and Indonesia and Brazil and Russia have never really bought into this sort of unit economy, of buying copies of CDs or downloads, because they didn't have the wherewithal to do it. They were never on the Western system that sort of hardened copyright; that doesn't work there. So in China this model is perfect because everybody participates, everybody pays, everybody gets. And that makes great sense when there's very large numbers of people. So you will see this come into place very soon and you will see it come into place in India where you're talking about 350 million cell phone users paying their \$.20 or \$.30 a month to get music.

**MS:** Are the music creators themselves really going to be able to recoup enough of a profit to make this



worthwhile for them?

**GL:** Well, it's not just this. The economic calculations have shown that if a flat rate is put into place at the rate of about \$1 a week, which of course would be much less in India or in Brazil, the total volume of music is already twice as much if you get everyone into the system. (And in most cases the users wouldn't actually pay; this would be completely ad and up-selling and sort of commission and affiliate supported.)

So the users themselves would perceive that as essentially built into the system, very much like if you're a blackberry user you don't count the emails, you just get them. This is why, again, if you have water, you're not worried about having a connection, you're just worried about filling up huge pools everyday because that will cost more. But anyway, I think that the rights holders are very happy about this because it gives them a guaranteed knowledge that everybody will actually be paying for music and then in addition, of course, they get this huge amount of marketing data back that the providers can share with them—the actual clicks, the amount of plays, the territories, the comments, the links, the shares, the bookmarks. That's basically free marketing for anybody who is in the content business. And that reduces their costs by another, what, 30 or 40 percent? That's a huge chunk. So the only real drawback is I can't say no; I can't say I don't want you to use my music on the web. And if that's what you want, then you shouldn't be publishing it because that is the reality today. In principle it would be nice if it could be the other way around, but it's not.

**MS:** You talk a lot in the book about how in the new paradigm what you'll really be after is attention, and I'm curious how advancing technology will really help niche genres like the ones that NewMusicBox largely speaks to, which have historically had a lot of problems with getting enough attention.

**GL:** The thing is, if you're good at getting attention, then you'll be good with that in real life or on the internet or somewhere else, you just have to learn how to do it. The main challenge for the average artist is not that people are taking free downloads; the main challenge is that nobody wants to download you—nobody can even be bothered to click on your name, right, because you're unknown. Today you can measure the value of media by how many people want to download it. It's not how many people want to pay, but how many people even want to try it. So the big challenge is not to turn the use into money, because that should be the part of the system that's built in, but how to get people to be interested in the first place.

When I was a musician 20 years ago, there was no online networking. There were no blogs, there were no free radio stations on the web; you had to do all that work by hand. And now you can have virtual radio stations streaming your music, using stuff like my own company, Sonific, or ReverbNation or, of course, MySpace and others. Now you can spread your images, now you can do blogging, all that stuff is free. So if what you offer is good and if you know how to attract attention in terms of what you get across, people will find you. And just like you do in real life, you play gigs. A band goes out and plays gigs. So that's what you do on the web; you play gigs—you put up your stuff, you publish your things, and if you're good and you keep it up, then people will find you.

**MS:** Do you think this is sustainably good from an artistic point of view, though? Now it becomes about buzz and how well you promote participation among users. Are there some purely artistic dangers there? You come from a music background and can sort of take a look at that from both sides, I think.

**GL:** Well, that danger is always present as an artist. Some artists are changing their art to be more popular. Other ones are even starting their art to be popular to begin with and yet other ones don't care at all, and they're still popular. What can I say? I think that ultimately whatever happens in media will influence artists to behave differently or to create different art. You know, now I find out when I write blogs I can't write like I write the book because nobody would read it; it would be too long. So I have to change my style. Well, in many cases I don't like changing my style so I use a different form. I think we're going to see artists do all kinds of things. Some people will have multimedia virtual life installations where you pay lots of money to go and interact with them and other ones will keep coming out on vinyl. That's not a bad



thing. I think that technology, like the nuclear bomb and nuclear power, does have those two sides to it. It can be used to the detriment and it can be used to the betterment. I think there are great dangers using technology as a substitute for artistic merit, which basically gives us heaps of garbage. However, I would much rather have a society that's empowered by technology tools than one that's completely limited by lack of them.

**MS:** You speak in the book about the changing economic picture that the industry and in particular the middlemen will have to shift to fit into in this new paradigm. I'm curious then how the net neutrality debates fit into this, because it seems like that's another door through which people are trying to get back in control.

**GL:** Well, I think there are two things to this equation. I think first, when content is legally licensed for use on digital networks, the traffic will go down because then I foresee people stopping the hamstering, the storing of content just because they can get it. Today you have kids downloading 50,000 songs and listening to 5 just because they are afraid it will be gone tomorrow. None of that will be happening anymore. There are studies about this, saying that if the content is licensed, traffic will go down, which alleviates the whole need for streamlining the web to perform better because everybody is using it for free downloading.

So that's one issue. The other one is that the very idea of policing the network to stop the transfer of certain content is just utterly ludicrous. I think that anybody who says that just doesn't know how it works and what people are doing. People are sharing music in a hundred different ways, including USB sticks, memory cards, flash memory, Bluetooth, Gmail, Gtalk, and what have you, right? They're using it with IM much more than with Limewire.

**MS:** In the book, I liked the analogy to the cell phone network and the concepts of how we pay a flat fee and then we're tempted with fancier phones and we pay more for other features. Framing it like that, with something we already use and which is economically successful, made it a little more comfortable.

**GL:** Yeah, I mean basically what we're seeing here is that everywhere you look, stuff that used to cost money is starting to feel like it's free. For example, airplane flights in Europe, well, I wouldn't say they're free but they're close to free—you just pay for the luggage. Email feels free, software feels free, operating systems become free with Google and Linux and other things, and there are many other examples, but still people get paid for creating this. So the question isn't really one of saying, "Is there money in the system?" but "Can we find a smarter way than the old way to monetize what we do?" And clearly for music, and then followed by film and TV, the issue can be solved by an access charge which essentially is bundled into the system so it feels like free—very important: not free, but feels like free—to the user. This is great news to the artist, great news for the user, and a little bit tougher for the middlemen, because they have to be transparent and they have to be sort of all on a level playing field.

**MS:** I was going to say, I like this idea. The only television programs I watch anymore I watch when I want to, online. But when I spoke to a friend of mine who works in the television industry and asked him how long it would be until all shows would be made available that way, he said it won't happen. They're not making any money off it, it's not going anywhere really and they are really frustrated with it. You paint a very rosy picture of how this could all work out, but do you think you've overshot it a little bit, or are they being shy?

**GL:** Well, I think basically the realization is that an engaged user is worth a lot of money, and a user that's being thwarted or being fought or being kept away isn't worth much money, and that happens no matter what kind of network; the internet just amplifies this. All television wants an audience, all artists want an audience, all radio wants an audience, so the creation of a powerful audience is number one. And for television, the way that they can create an individual world-wide audience now is absolutely a huge opportunity for them, but they have to change the model to be based less on this advance fee or copy fee or physical thing, but [instead] on a share of the revenues of what happens during the engagement.



For example, people click on links, they buy other products there, they're up-sold to buying concert tickets or merchandise. There's lots and lots of options. If you want to read more about this issue, check out Kevin Kelly, who was the editor of *Wired* magazine, who has a lot of interesting articles about this on [his blog](#). I use some of his stuff as well; it's really great stuff. It's basically explaining to us that in a system where content is becoming sort of, I wouldn't say a commodity, but a "0 and 1" thing that can be copied, then it's the intangible that becomes really powerful—the added value. So, in other words, you may not be selling a copy of a TV show, but you sell everything around it. You sell the branding, the sponsorship, the advertising of course, the access to community of fans, the brand around the TV show—pretty much like the for some TV shows it has already been in the past. So the shift isn't really that big except that we have to be prepared to say, well, it's no longer just the copy that matters, it's the context.

**MS:** In a way, your own career mirrors this system. You collect your writings from your blog and turn them into a book that you then make available for download. And then this all plays into, I assume, your "live performances"—your speaking engagements, outside articles, and such. Is this working out for you? You have a career that you've built on almost exactly the same model you're describing for the music industry.

**GL:** Don't forget that I was a musician myself, so for my part, I know what it's like to live in the product world where it's already clear to like 99.9 percent of the artists that they'll never see any money from the product of music. You get a couple nickels and dimes. I made 20 records, but I didn't see much money. That might have been the fault of the records [laughs] but in any case, now I provide my content more or less for free and it works out great. I get to do a lot of really interesting speaking engagements, I do really interesting advisory sessions and think tanks, and the value is in the network. In other words, it's not in keeping a .pdf to myself, but in spreading it as far as it will go and then creating value that way.

I think that at a certain level—this also very important—that if you reach a certain level of prominence in the network, then you can turn the product back into money. So if you're reading Chris Anderson for free at *Wired* magazine, I think he can actually sell quite a few printed books and make money with that too because he's reached a certain liquidity in the virtual sense that he can turn into money. So in other words, as a musician, if you're at the peak of things, if you're a global star, you can sell records, you can sell DVDs, you can sell physical things, but to get to that point, you don't get there by insisting on the physical things first.

**MS:** You mention in the book how record labels are always asking you to predict the future. But looking at it from a composer's point of view, what should composers be focused on? Since it seems like your predictions for the industry make a lot of sense, if they do indeed come to pass where should composers be looking so they're ready for it?

**GL:** Well, you know, underneath every song, underneath every ad campaign, underneath everything creative there's an idea, and composers, to me, they provide ideas, whether they're audio ideas or other ideas. And the creation of ideas is not something that comes easy to a lot of people. Technology will never substitute for the creation of ideas just because you have better tools. So composers, and creative people in general, will be much more in demand than ever before.

Also, we'll be using a lot more media. Tens of thousands of TV channels, rich media advertising, mobile advertising, we're talking about a huge boom in the creation of media. The thing to do for a composer is to use all these tools that are available to get the word out about what they do. I think the major areas of growth are things like games, obviously. Motion pictures that are premiered on the web, which is now becoming a fantastic way for composers to show what they do without having to have a major contract, without the gate of Hollywood. So all these things become a huge pipeline.

The only thing I think you have to be aware of: I think we do have a sort of digital Darwinism here. Because we have so many people offering it and so many people wanting it, there's quite a bit of pressure on the merit. So unlike the old days where you could be a lousy singer and you could still be successful,



today that's going to be next to impossible. Quality today—we're living in a meritocracy, right? If you read my blog and you think it sucks, you won't come back. You won't even let me know. And the same is true for writers, for composers, for lyricists. The difference is that the middle is removed—the control is no longer with just a few people who are holding the key to the kingdom.

Having said that, I think the future of publishing is quite clear on the web because the web is essentially a publishing machine. Music publishers stand to heavily profit from the web as long as they agree on a revenue share—which they are pretty much doing, but they should go further. If you are looking at the growth in revenues from ASCAP and BMI, their performance revenues are growing, synchronization licenses are growing, all these things are growth factors. All we really have to do as creators is say yes, use my stuff and here's the deal.

<http://www.newmusicbox.org:80/article.nmbx?id=5555>





## Turning over an old leaf

Only 24 books are produced for every tree felled. But book-swapping websites could provide a solution for the eco-aware reader. Charlotte Northedge reports

- Charlotte Northedge
- [The Guardian](#),

This article appeared in [the Guardian](#) on [Thursday May 01 2008](#) on p18 of the [Comment & features](#) section. It was last updated at 12:34 on May 05 2008.

The cover is creased and the edges slightly curling, but otherwise *The Memory Keeper's Daughter* is in surprisingly good condition for a book that has travelled more than 1,000 miles and been through seven pairs of hands.

"I don't bother about creases on the cover or the spine," says Wendy Evans, 48, the seventh and current owner of Kim Edwards' novel, which has travelled from Preston to Leicester via Glasgow and Dorset before landing on her doorstep in Sheffield. "I do object to food residue, but this one's in pretty good nick."

Evans has exchanged 135 books through [ReadItSwapIt.co.uk](#) since last August. "It's addictive," she says. "I can try out authors I wouldn't normally read and I don't feel guilty if I give up halfway. I'm not paying for the book, and I'm not throwing it away after I've read it or leaving it to gather dust on a shelf."

For eco-aware readers, the environmental benefits of swapping rather than buying are clear. In 2003, Greenpeace launched its book campaign, producing evidence that the UK publishing industry was inadvertently fuelling the destruction of ancient forests in Finland and Canada. It found that one Canadian spruce produces just 24 books, which means that if you get through one book every two weeks your reading habits destroy almost one large tree every year. (In the same year, Greenpeace persuaded Raincoat Books to produce the Canadian edition of *Harry Potter and the Order of the Phoenix* on recycled paper, saving an estimated 39,000 trees.) But despite the campaign, only 40% of the UK book industry has introduced paper with a high level of recycled content, largely choosing to use paper certified by the Forest Stewardship Council instead.

Beyond using the country's dwindling network of libraries, until recently the opportunities for exchanging paperbacks have been limited to friends, community schemes and book groups. But in the past two years, a spate of online book-swapping sites have emerged. Inspired by the goodwill schemes operated by hostels around the world, whereby travellers can leave behind books they have read and pick up something new, these sites generate little profit for their founders. The books are swapped directly between users, who pay the postage; the sites simply facilitate the meeting and identifying of potential exchanges.

On [BookMooch.com](#), a site run from California, users enter the titles of the books they want to give away, and earn credit that enables them to borrow each time they swap a book. "I was inspired by a community centre I saw on holiday in Norwich," says founder John Buckman. "It had a bookshelf outside with a sign saying, 'Leave a book, take a book'. I liked the idea of them circulating around the world."

What sets BookMooch apart from sites such as [WhatsOnMyBookshelf](#), [PaperBackSwap](#) and [Bookins](#), is its international scale: it has 68,930 users in 91 countries. Since its launch in 2006, nearly 700,000 books have been swapped; *The Memory Keeper's Daughter*, the most exchanged - or "mooched" - book, has been swapped 755 times. Edwards' tale is something of an online sleeper hit, beating bestsellers such as Khaled Hosseini's *The Kite Runner* and Ian McEwan's *On Chesil Beach* to the top spot on both BookMooch and ReadItSwapIt.





Earlier this year, Philip Felstead, 57, from Dorset, was the fifth person to read the well-thumbed copy that now sits on Evans's bedside table. "It's not a book I would have bought," admits Felstead, whose job involves publishing of a different kind: monographs by retired diplomats. "But I read two or three books a week in the evenings, and I was looking for something fun." Felstead, who has been using the site for 18 months, passed the book on to Teresa in Leicester, who in return sent him *Engleby* by Sebastian Faulks. "Extremely interesting," is his verdict. "I've been introduced to many authors I'd never have tried."

Some readers include a note - just a friendly hello, or a recommendation - creating a sense of community and continuity. Some even meet up to swap books and discuss them in person, says Martin Bathgate, founder of [ReadItSwapIt.co.uk](http://ReadItSwapIt.co.uk). "Our forum is a great social tool. People who like books tend to like each other."

Evans also welcomes the social aspect of book-swapping. An administrator at the church army training college in Sheffield, she used to rely on church book sales or the local library, "but they didn't always have the most recent books. Getting hold of new novels and talking to people about them makes a real difference".

Of course, those churches and charity shops that made money from second-hand book sales stand to lose out, as do the publishing industry and authors. "In the music industry, this kind of thing would be called 'file sharing', and technically illegal," the author Jeanette Winterson wrote of book-swapping sites recently.

"Of course I want people to read my books, but I also want people to buy my books."

But Buckman and Bathgate argue that the sites function alongside libraries and bookshops to provide access to a wider range of titles, encouraging readers to encounter new authors and keeping older titles in print. "People who use the site become fans of books and end up buying more," says Buckman. "One in 20 of the books exchanged is also purchased."

Despite working in publishing himself, Felstead is philosophical about the impact on the industry. "I suppose one doesn't worry so much about the bookshops these days, because they're all large chains that make most of their money selling coffee. And authors should be pleased that their work is being disseminated around the world."

The Memory Keeper's Daughter, meanwhile, is about to go to its next home. At first, Evans says, she felt uncomfortable about sending her books to strangers. "I was brought up to take care of my books," she explains. "But at least I know it's going to a good home, to someone who wants it, not to sit on a shelf or be thrown away".

<http://www.guardian.co.uk/environment/2008/may/01/ethicaliving.recycling/print>

### ***City to mark 100th anniversary of Burnham Plan***

By Blair Kamin

Tribune critic

May 5, 2008

The publicity drums already are beating for next year's 100th anniversary celebration of the Burnham Plan, the masterful urban planning document that changed the face of Chicago and established the field of city planning worldwide. Officially called the Plan of Chicago, the 1909 plan was co-authored by Chicago architects Daniel Burnham and Edward Bennett (everybody always forgets Bennett) and sponsored by the Commercial Club of Chicago.

Among its legacies: North Michigan Avenue, the Michigan Avenue bridge, Wacker Drive, Congress Parkway, Roosevelt Road, Northerly Island and Chicago's continuous chain of lakefront parks. Most important, in successfully remaking key portions of booming but chaotic Chicago, the plan revealed that cities everywhere could be reshaped to provide generous public spaces and, with them, a sense of community.

Expect a June 24 announcement from the Burnham Plan Centennial Committee, including the tantalizing—and already controversial—possibility that two Pritzker Prize-winning architects may design special (and presumably temporary) pavilions in Millennium Park to mark the plan's centennial.

With the debate over the Chicago Children's Museum's plan for a mostly underground new facility in Grant Park looming in the background, commentators on my blog—[www.chicagotribune.com/theskylines](http://www.chicagotribune.com/theskylines)—don't like the idea of cluttering Grant Park with another building, even if it's temporary.

One writes: "A new plan is needed for the next 100 years in Chicago, and it's time to move away from the lakefront, which is so full they're burying stuff to fit it in."

- Speaking of the Children's Museum battle, the Union League Club of Chicago on Tuesday will hold a forum featuring two principals in the debate: Jennifer Farrington, the museum's president and chief executive officer, and Ald. Brendan Reilly (42nd), who has defied Mayor Richard M. Daley in opposing the museum's plan. The public is welcome. The discussion will start at 8 a.m. at the club, 65 W. Jackson Blvd. You can sign up by calling 312-435-5946. Cost is \$20 per person. The event begins with breakfast at 7:30 a.m. The club promises that adjournment will occur no later than 9:30 a.m. The club has not taken a position on the controversy.

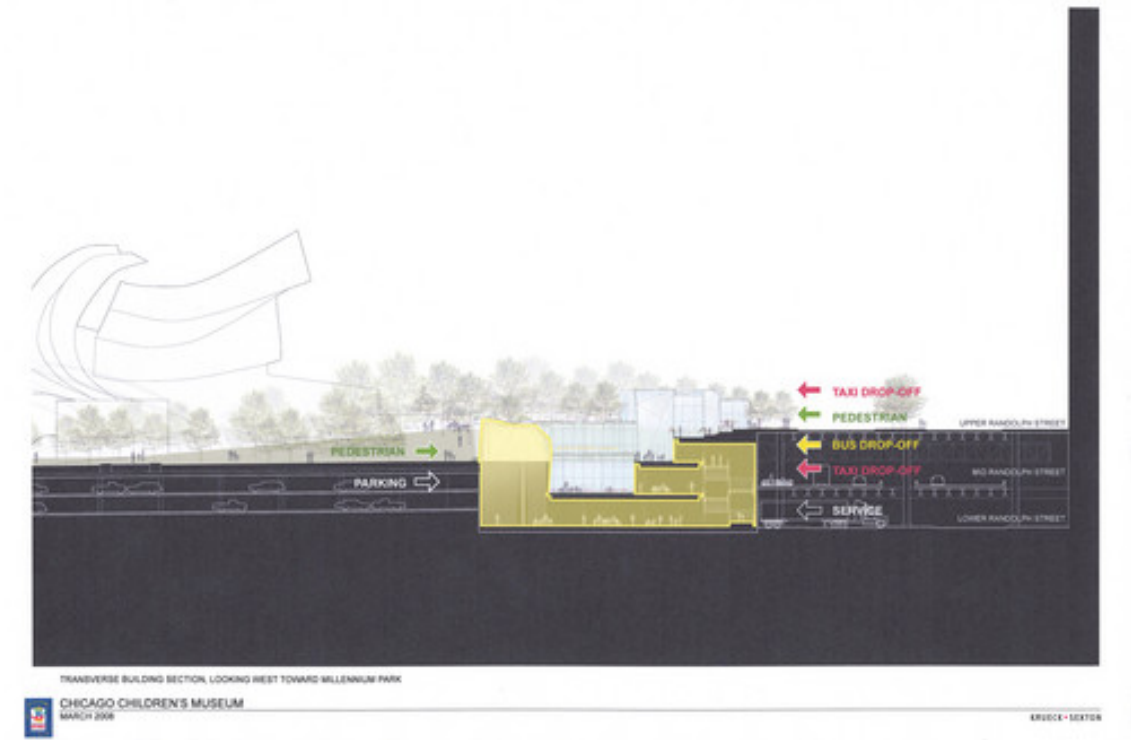
[bkamin@tribune.com](mailto:bkamin@tribune.com)

[www.chicagotribune.com/entertainment/arts/chi-kamin-archnotes-0505may05,0,7569106.story](http://www.chicagotribune.com/entertainment/arts/chi-kamin-archnotes-0505may05,0,7569106.story)

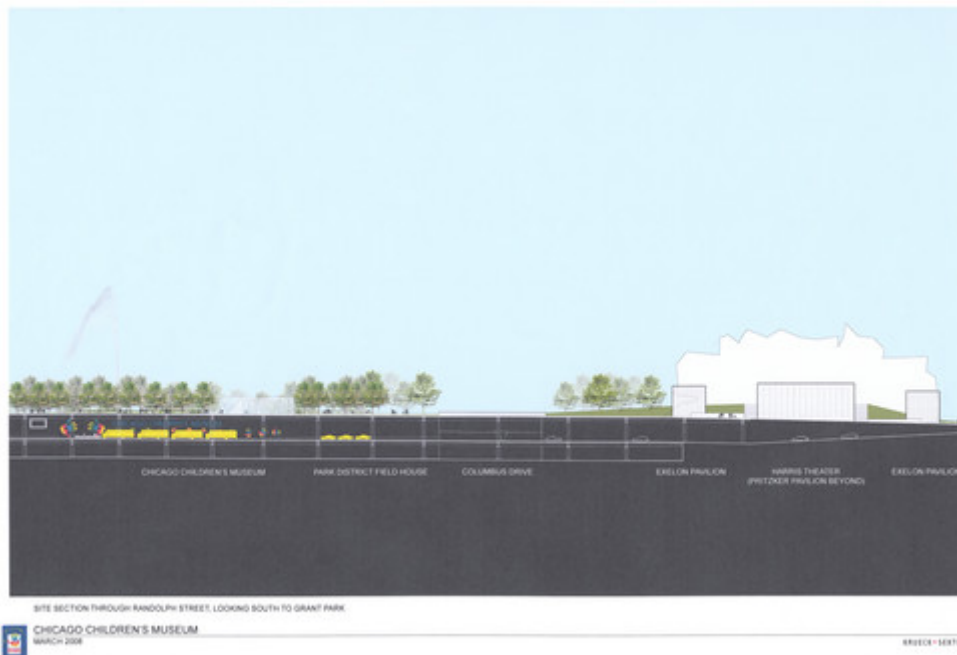
The latest Chicago Children's Museum plans



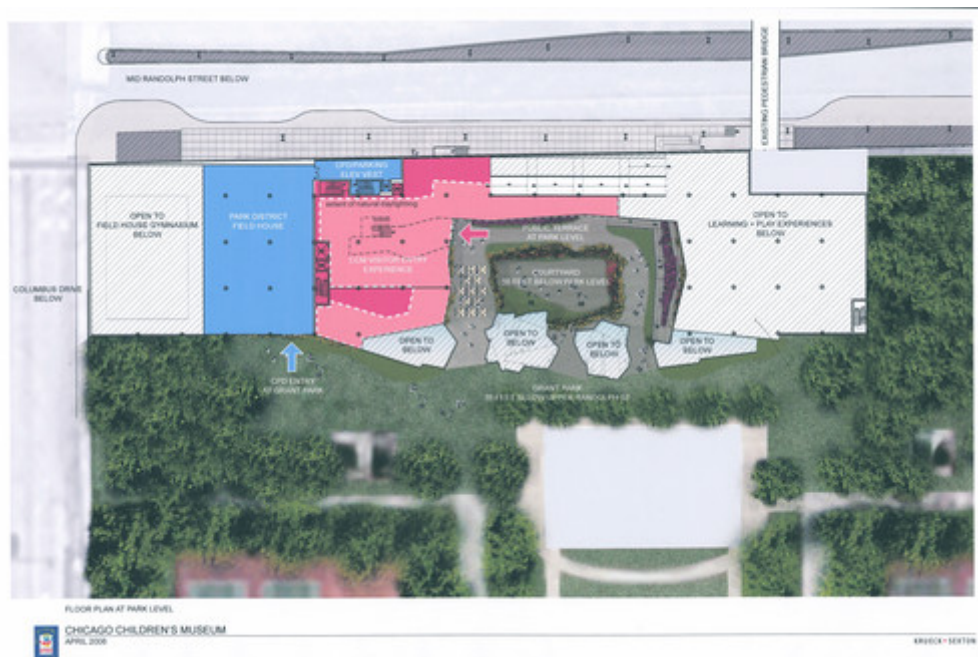
Photo of existing Daley Bicentennial Plaza site: This view (from composite photos) faces toward the northwest, toward the skyscrapers of central Michigan Avenue and Upper Randolph Street. In the background is an existing Chicago Park District field house, most of which is buried below ground. The field house's concrete facing and dark glass walls are visible. (Handout / April 4, 2008)



Transverse Building Section, Looking West Toward Millennium Park: This cross-section reveals how the vast majority of the museum would be buried below ground. The arrows at right show where taxis, pedestrians, buses, taxis and service vehicles like trucks would arrive at the museum. The two-level parking garage is at left. Between them is the museum itself, punctuated by the courtyard (in light blue) in the center. In the left portion of the courtyard is a climbing wall area. It would be topped by one of the four skylights. (Handout / April 4, 2008)



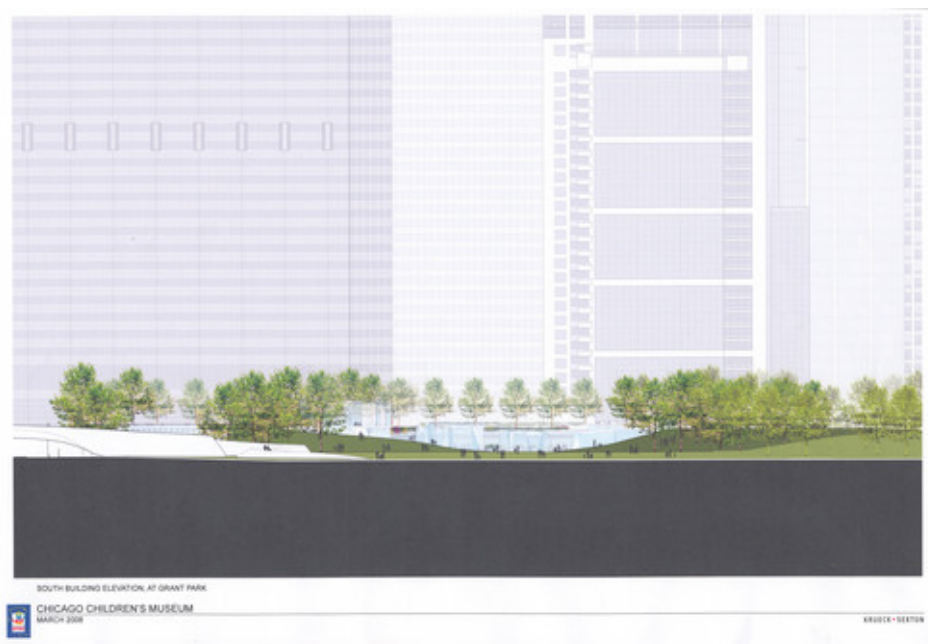
Site section through Randolph Street, Looking South to Grant Park: This view shows the relative height of the entrance pavilion compared to the Harris Theater and the Exelon Pavilions at Millennium Park. The Pritzker Pavilion is shown in white in the background. (Handout / April 4, 2008)



Floor Plan at Park Level: Ramps would lead museum visitors to the level of Grant Park, 16 feet beneath Upper Randolph Street. Here, museum visitors would encounter the museum's "visitor entry experience" and would buy tickets to enter the museum. Alternatively, visitors could walk up ramps from Daley Bicentennial Plaza to reach the ticketing area. At the center of the floor plan is a sunken courtyard, a revised element of the architects' design. Cafe tables are located to the left of the courtyard. The four skylights are all located at this level and are open to museum



Floor Plan at Upper Randolph Street: This floor plan shows that there would be two separate entrances leading into the entry pavilion. The first, in blue, would lead to the Chicago Park District field house and to the parking garage beneath Daley Bicentennial Plaza. The second, in pink, would be the entry to the Chicago Children's Museum. It would be four feet below the other entry and would be reached by stairs or an elevator. An outdoor ramp (at right, in brown) would lead to or from Daley Bicentennial Plaza. Roof gardens are suggested on either side of the museum. (Handout / April 4, 2008)



South Building Elevation at Grant Park: This drawing looks north, with the skyscrapers of Upper Randolph in the background and the snaking form of the Frank Gehry-designed BP Bridge at left. Visible in the center, resembling ice cubs, are the four skylights of the Children's Museum. Above them, to the left and partly hidden by trees, is an entry pavilion along Upper Randolph. (Handout / April 4, 2008)

<http://www.chicagotribune.com/entertainment/arts/chi-080406museum-photogallery.0.6995552.photogallery>

## At Kodak, Some Old Things Are New Again

By CLAUDIA H. DEUTSCH



ROCHESTER — Steven J. Sasson, an electrical engineer who invented the first digital camera at Eastman Kodak in the 1970s, remembers well management’s dismay at his feat.

“My prototype was big as a toaster, but the technical people loved it,” Mr. Sasson said. “But it was filmless photography, so management’s reaction was, ‘that’s cute — but don’t tell anyone about it.’ ”

Since then, of course, Kodak, which once considered itself the Bell Labs of chemistry, has embraced the digital world and the researchers who understand it.

“The shift in research focus has been just tremendous,” said John D. Ward, a lecturer at the Rochester Institute of Technology who worked for Kodak for 20 years. Or, as Mr. Sasson put it, “Getting a digital idea accepted has sure gotten a lot easier.”

Indeed, physicists, electrical engineers and all sorts of people who are more comfortable with binary code than molecules are wending their way up through Kodak’s research labs. “When I joined, I knew my salary came from film sales,” said Dr. Majid Rabbani, an electrical engineer who joined Kodak in 1983. “But I knew that I would eventually produce paychecks for others.”

Kodak is by no means thriving. Digital products are nowhere near filling the profit vacuum left by evaporating sales of film. Its work force is about a fifth of the size it was two decades ago, and it continues to lose money. Its share price remains depressed.



But, finally, digital products are flowing from the labs. Kodak recently introduced a pocket-size television, which is selling in Japan for about \$285. It has software that lets owners of multiplexes track what is showing on each screen. It has a tiny sensor small enough to fit into a cellphone, yet acute enough to capture images in low light.

The company now has digital techniques that can remove scratches and otherwise enhance old movies. It has found more efficient ways to make O.L.E.D.'s — organic light-emitting diodes — for displays in cameras, cellphones and televisions.

This month, Kodak will introduce Stream, a continuous inkjet printer that can churn out customized items like bill inserts at extremely high speeds. It is working on ways to capture and project three-dimensional movies.

And, of course, it continues to prompt consumers to take pictures with Kodak cameras, store them at Kodak sites online, display them in Kodak digital picture frames and print them on Kodak printers that use Kodak inks and papers.

“They want to be the World Bank of Imaging, to offer a Kodak-branded solution for anything you might want to do with images,” said Matthew Troy, an analyst with Citigroup Investment Research, who recently upgraded Kodak to hold from sell.

Paradoxically, many of the new products are based on work Kodak began, but abandoned, years ago. The precursor technology to Stream, for example, pushed ink through a single nozzle. Stream has thousands of holes and uses a method called air deflection to separate drops of ink and control the speed and order in which they are deposited on a page.

“I remember wandering through the labs in 2003, and seeing the theoretical model that could become Stream,” said Philip J. Faraci, Kodak's president. “The technology was half-baked, but it was a real breakthrough.”

Other digital technologies languished as well, said Bill Lloyd, the chief technology officer. “I've been here five years, and I'm still learning about all the things they already have,” he said. “It seems Kodak had developed antibodies against anything that might compete with film.”

It took what many analysts say was a near-death experience to change that. Kodak, a film titan in the 20th century, entered the next one in danger of being mowed down by the digital juggernaut. Electronics companies like Sony were siphoning away the photography market, while giants like Hewlett-Packard and Xerox had a lock on printers.

“This was a supertanker that came close to capsizing,” said Timothy M. Ghriskey, chief investment officer at Solaris Asset Management, which long ago sold its Kodak shares.

But in 2003 Kodak hired Antonio Perez away from Hewlett-Packard. Mr. Perez, now the chief executive, has sprinkled Hewlett alumni — including Mr. Lloyd and Mr. Faraci — throughout the executive suite.

Together, they have turned Kodak inside out. They exited a mainstay business, health imaging, and took the company back into inkjet printing. And they mined the patent archives for intellectual property, a step that is yielding well above \$250 million a year in licensing fees. One recent example: Kodak is licensing out a method to embed a chemical signature in materials that enables manufacturers and retailers to scan for counterfeit products.

“When it comes to intellectual property, they're finally acting like a for-profit corporation instead of a university,” said Ulysses A. Yannas, a broker at Buckman, Buckman & Reid who has been buying Kodak shares.



The Hewlett alumni introduced an expensive consumer printer that runs on inexpensive ink — tantamount to heresy in an industry that has always sold cheap hardware in hopes of making money on high-margin inks and toners. “We were entering an entrenched market, so we went after the biggest dissatisfier for consumers, the cost of ink,” said Steven A. Billow, a manager in the inkjet systems division

And, perhaps most traumatic for a company that was known as the Great Yellow Father in Rochester, they eliminated jobs. Kodak, which employed 145,300 people 20 years ago, ended 2007 with 26,900 employees.

Last year, \$6.4 billion of its \$10.3 billion in revenue came from digital products, but it earned only \$179 million from them. And on Thursday, Kodak announced a first-quarter loss of \$114 million on revenue of \$2.09 billion. It was an improvement over the first quarter of 2007, when it lost \$175 million on revenue of \$2.08 billion. And Kodak’s revenue from digital products rose 10 percent, to \$1.366 billion.

Mr. Perez told analysts he had “full confidence” that 2008 would be a good year for Kodak, but investors did not share it. Its shares fell 67 cents on Thursday, to \$17.22. After peaking at \$94.25 in February 1997, they have steadily trended down.

Analysts remain wary. “The stuff that comes out of the Kodak labs is impressive, but it does not give them a leg up on Hewlett or Xerox,” said Shannon S. Cross, an analyst at Cross Research who rates Kodak a sell. Nor is she impressed with Kodak’s consumer printer. “Consumers buy on the cost of hardware, not of total ownership,” she said.

The Fujifilm Corporation, the Japanese company that was Kodak’s main film rival, is not out of the picture, either. It recently moved its chemistry and electronics labs next door to each other. “If they work as a single team at the same location, R.& D. productivity is significantly enhanced,” Shinpei Ikenoue, the head of research at Fujifilm, said in an e-mail message.





Still, analysts no longer predict Kodak's demise. "Kodak still has the most color specialists," Ms. Cross said.

There are a lot fewer of them, though. The research ranks have been cut in half, to about 1,000 people. "We watched a lot of chemists get downsized out of jobs," said Dr. Margaret J. Helber, an organic chemist who joined Kodak 18 years ago. "The rest of us soldiered on for several years, not knowing if we would remain relevant in the transformed Kodak."

They did, but in radically altered jobs. For one thing, researchers who rarely interacted are now expected to collaborate.

"This used to be a closed society, where some researchers kept their records in locked safes," said Dr. John D. Baloga, director of analytical science and a Kodak employee for 31 years. "Some of them were crushed when the secrecy went away."

Researchers also must now work with the business managers. Amit Singhal, a computer scientist who joined Kodak in 1998, said he had biweekly meetings with the business units. "I never used to see them at all," he said.

Indeed, until recently, functions like finance, marketing and research all reported up through their own hierarchies, ultimately to the chief executive. Today, everyone involved in creating, selling and servicing inkjet printers is grouped together, as are those dealing with cameras, sensors or other products.

"Finally, we have a structure that promotes commercialization of research," Mr. Faraci said.

The research chiefs do hold quarterly meetings to uncover technologies that can cross product boundaries. Marketing, operations and customer service chiefs meet regularly as well, to discuss which products and services can be bundled together for sale, or to see whether economies of scale can be achieved. But day to day, researchers and marketers deal more with each other than with their functional peers.

"Researchers invent something, demonstrate its feasibility, talk about commercializing it," said Julie Gerstenberger, vice president for external alliances. "But these days, it's all in collaboration with the business side."

<http://www.nytimes.com/2008/05/02/technology/02kodak.html?th&emc=th>

## 'LES LIAISONS DANGEREUSES'

### What Lurks Beneath the Ruffles

By **BEN BRANTLEY**

Correction Appended



Hedonism becomes a gravitational force in Ben Daniels's compelling turn as an 18th-century libertine in "Les Liaisons Dangereuses," which opened Thursday night in an eye-filling, very imbalanced revival at the American Airlines Theater. Making a sensational Broadway debut in Rufus Norris's production, which also stars an uncomfortably cast [Laura Linney](#), this London actor seems at all times pulled, pummeled and shaped by the prospect of physical pleasure.

From the moment Mr. Daniels makes his entrance as the Vicomte de Valmont, the satin-cloaked satyr of [Christopher Hampton](#)'s 1985 adaptation of Pierre Choderlos de Laclos's 1782 novel, his very posture evokes a man who hears the call of earthly delights at high volume. The thrust hip, the insinuatingly arched back, the precisely crooked arms and knees: these all suggest not only the rococo stance of a nobleman in the age of Fragonard but also a fatal receptiveness to appetite and instinct. The boy can't help it, which means, in a world governed by calculation, there's no way he's going to survive.

Mr. Daniels provides both the silliest and most serious rendering I've seen of Valmont, who has been memorably played onstage by [Alan Rickman](#) (in the [Royal Shakespeare Company](#) production that came to Broadway in 1987) and on screen by [John Malkovich](#) (in [Stephen Frears](#)'s "Dangerous Liaisons") and [Colin Firth](#) (in [Milos Forman](#)'s "Valmont"). His warm, fluid performance reflects what would appear to be Mr. Norris's intention: to turn up the temperature in a work of famously icy cynicism. Unfortunately no one else in this revival approaches Mr. Daniels's level of complexity, including Ms. Linney, a wonderful actress who has been shoehorned into a part out of her natural range and is perceptibly pinched.



As a consequence this portrait of a pair of amoral aristocrats who play the game of love as if it were a game of chess often registers with the bouncy bawdiness of a Restoration comedy (right down to a flatulence gag). When the plot turns truly nasty, it's hard to feel the requisite shivers, and the show often wears the tight smirk of a protracted dirty joke in fancy dress.

This being a Roundabout Theater Company production, the dress is fancy all right. Katrina Lindsay's lustrous costumes could surely have passed muster at Versailles, while Scott Pask's set, a dark wall of windows garlanded with swags and pull cords, is just the place for voyeurs who live to catch their reflections in the glass, as well as the compromising doings of others. A tenor and soprano are on hand to sing stately songs by Handel, among others.

Mr. Norris isn't wrong to give such attention to surface detail. For Valmont and the Marquise de Merteuil (Ms. Linney), former lovers locked in a sexual conspiracy and competition, clothing is battle gear. (The opening section of Mr. Frears's movie was largely devoted to close-ups of the main characters being poured, laced and buttoned into their lavish daily wear.)

The way you wear your hat (or should I say your perruque?) — or your pannier or knee breeches — in this hothouse environment is a signal of how well you understand the rules of your society. And no one grasps those rules better than Valmont and Merteuil, all the better to turn them into weapons in their games of conquest, betrayal and revenge. (Laclos was, appropriately, a French artillery officer with a keen interest in military strategy.)

It's a problem, though, when only Valmont and, to a lesser extent, Merteuil seem to be of their time. The supporting cast here is perfectly creditable, including Kristine Nielsen (as a foolish mother), Jessica Collins (as the righteous object of Valmont's most ardent designs) and, quite enjoyably, Mamie Gummer and Benjamin Walker as the most naïve and ungainly of victims.

But aside from the venerably elegant Sian Phillips, who plays Valmont's worldly aunt (and played Madame de Volanges, Ms. Nielsen's character, in the Forman film), they feel like contemporary creations. They're stranded in a distant era, as well as being none too bright. Of course they don't understand what Valmont and Merteuil have in store for them. They are, to warp a phrase, sitting pigeons for two wily cats, and for much of the play, we laugh as they fall blindly into traps. As Valmont says, when Merteuil proposes he seduce Ms. Gummer's character, "It's too easy."

Still, I suppose it's just as well these folks are as dim as they are, since anyone with any common sense would back away fast from Ms. Linney's scarily severe Merteuil. In film ("You Can Count on Me," "The Savages") and on Broadway ("The Crucible," "Sight Unseen"), Ms. Linney has established herself as an actress of peerless emotional transparency, capable of conveying a multitude of conflicting feelings through minimal means.

Here she is required to wear a mask of hypocrisy, and it doesn't fit. Whether scheming with Valmont, pretending to be a pillar of rectitude or being serviced by a young lover, this Merteuil is made of unyielding stone. I think I see where Ms. Linney is coming from: she's picked up on the character's feminist anger and bitterness. She is at her best in her seething monologues about the lot of women. And more than any I've seen, this "Liaisons" hints that the Marquise might prefer her own sex.

But when she says contemptuously of the puritanical Madame de Tourvel (Ms. Collins), "They never let themselves go, these people," she might be describing herself. Wintry to the point of frigidity, this harsh schemer seems incapable of enjoying anything, even being mean. And the luxuriant complicity that Mr. Rickman and Lindsay Duncan embodied so seductively in the original Broadway version is all but nonexistent between Ms. Linney and Mr. Daniels.

Parents hoping to treat their children to an educational visit to pre-Revolutionary France, be warned: Mr. Norris, whose current "Cabaret" in London is notable for its explicit coital ballets, makes a point of



revealing what's beneath those big skirts and tail coats. Several sexual positions are specifically simulated, and Mr. Daniels and Mr. Walker are, briefly, starkers.

Even buck naked, though, Mr. Daniels seems comfortably clothed, just as when he's fully clothed he seems comfortably naked. His Valmont is a remarkably consistent creation, a man of exuberant moral passivity, more hopelessly sybaritic than truly evil. It makes sense when he is surprised by deeper feelings.

I'm not sure that's what Laclous had in mind when he conceived Valmont. But Mr. Daniels's reading of the part can be fully justified by the script. The line that proves to be Valmont's undoing — "It's beyond my control" — might well be his mantra throughout. In his final scene Mr. Daniels turns a prolonged sword fight (expertly staged by Rick Sordelet) into a portrait en précis of Valmont's whole life. It stands out as a miniature masterpiece of light and shadow in a production that otherwise never quite bridges those extremes.

### LES LIAISONS DANGEREUSES

By Christopher Hampton, based on the novel by Choderlos de Laclous; directed by Rufus Norris; sets by Scott Pask; costumes by Katrina Lindsay; lighting by Donald Holder; sound by Paul Arditti; hair and wig design by Paul Huntley; voice and speech coach, Deborah Hecht; fight director, Rick Sordelet; production stage manager, Arthur Gaffin; general manager, Sydney Beers; technical supervisor, Steve Beers; associate artistic director, Scott Ellis. Presented by the Roundabout Theater Company, Todd Haimes, artistic director; Harold Wolpert, managing director; Julia C. Levy, executive director. At American Airlines Theater, 227 West 42nd Street, Manhattan, (212) 719-1300. Through July 6. Running time: 2 hours 40 minutes.

WITH: Laura Linney (La Marquise de Merteuil), Ben Daniels (Le Vicomte de Valmont), Sian Phillips (Madame de Rosemonde), Jessica Collins (Madame de Tourvel), Mamie Gummer (Cécile Volanges), Kristine Nielsen (Madame de Volanges), Benjamin Walker (Le Chevalier Danceny), Rosie Benton (Émilie), Derek Cecil (Azolan), Kevin Duda (Footman/Tenor), Tim McGeever (Major-domo), Jane Pfitsch (Maid/Soprano), Nicole Orth-Pallavicini and Delphi Harrington (Servants).

<http://theater2.nytimes.com/2008/05/02/theater/reviews/02liai.html?th&emc=th>



## **Extreme Nausea And Vomiting Varies Among Pregnant Women From Different Countries**

ScienceDaily (Apr. 26, 2008) — Mothers born in India and Sri Lanka are three times more likely to suffer from extreme nausea and vomiting in pregnancy (hyperemesis gravidarum) than ethnic Norwegians. This finding comes from Norwegian Institute of Public Health's study of 900, 000 first-time pregnancies registered in the Medical Birth Registry of Norway over a forty year period.

Earlier studies reported that 90 percent of pregnant women experience some degree of nausea and vomiting, whereas 0.5 to 2 percent have hyperemesis gravidarum. Due to dehydration, loss of important electrolytes, malnutrition and weight loss, hyperemesis gravidarum could be life-threatening for mother and baby if left untreated. In the USA it is the commonest cause for hospitalisation during early pregnancy. The cause of hyperemesis gravidarum is unknown.

Åse Vikanes, specialist in gynaecology and obstetrics at the institute's Division of Epidemiology, wanted to explore whether the mothers' country of birth affected the prevalence of hyperemesis gravidarum. Vikanes is primary author of the paper "Variations in prevalence of hyperemesis gravidarum by country of birth: A study of 900, 074 pregnancies in Norway, 1967-2005."

### **Large study on hyperemesis gravidarum**

Vikanes and her colleagues collected data from the Medical Birth Registry of Norway, which since 1967 has recorded data on all pregnancies and pregnancy complications. 8, 300 cases of hyperemesis gravidarum were recorded out of 900, 000 pregnancies, giving an overall prevalence of 0.89 percent. Data on the mother's country of birth and education were recorded by Statistics Norway and linked to pregnancy information through the mother's unique personal identification number. Socio-demographic factors such as marital status, country of birth, education, age and number of foetuses in each pregnancy were also studied.

"This is one of the largest studies carried out on hyperemesis gravidarum. In contrast to earlier studies we tested the quality of the data and therefore have confidence in our findings" says Vikanes.

Mothers born in India and Sri Lanka had the highest prevalence of hyperemesis gravidarum, followed by those born in Africa (excluding North Africa) and Pakistan by 3.2 percent, 3.1 percent and 2.1 percent, respectively. Ethnic Norwegians, North Americans and Western Europeans had the lowest prevalence by 0.9 percent, 0.9 percent and 0.8 percent, respectively. Maternal age between 20-24 years old, being married, carrying a female foetus or more than one foetus were all socio-demographic characteristics associated with a higher prevalence of hyperemesis gravidarum.

### **Need to study further**

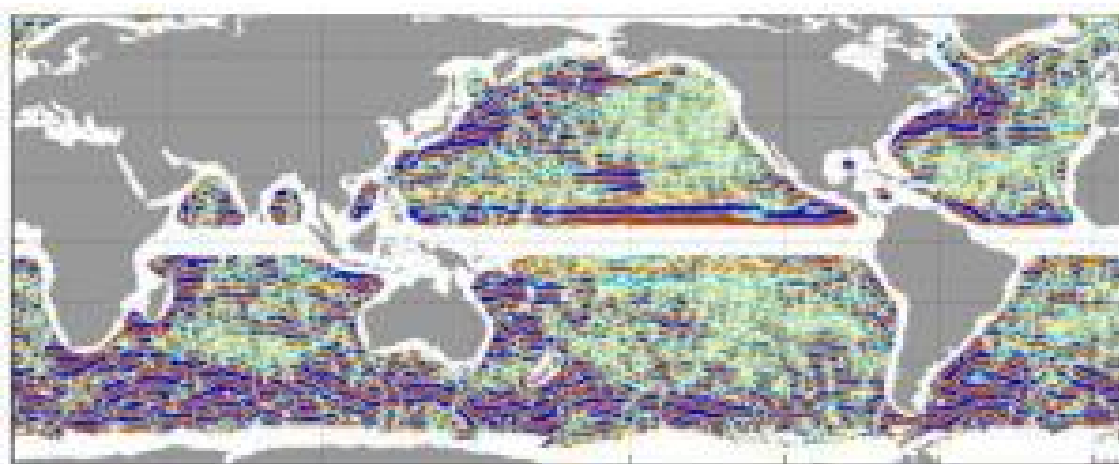
"The difference in prevalence of hyperemesis gravidarum related to the mother's country of birth cannot be explained by differences in socio-demographic characteristics", says Vikanes. "We have to look for other explanations such as genetic factors, a change of diet or a history of infections. This topic needs further research to identify ways to prevent this life-threatening and distressing condition."

Journal reference: Vikanes A, Grjibovski AM, Vangen S and Magnus P. (2008) Variations in prevalence of hyperemesis gravidarum by country of birth: A study of 900, 074 pregnancies in Norway 1967-2005. *Scandinavian Journal of Public Health* 36: 135-142.

*Adapted from materials provided by Norwegian Institute of Public Health.*

<http://www.sciencedaily.com /releases/2008/04/080425102414.htm>

## Scientists Reveal Presence Of Ocean Current 'Stripes'



*A worldwide crisscrossing pattern of ocean current striations has been revealed through measurements made by drifting buoys over a period of more than 20 years and through satellite readings of ocean velocity. Blue bands represent westward-flowing currents and red bands indicate eastward-flowing currents that move at roughly 1 centimeter per second. (Credit: Image courtesy of Nikolai Maximenko, University of Hawaii.)*

ScienceDaily (Apr. 26, 2008) — More than 20 years of continuous measurements and a dose of "belief" yield discovery of subtle ocean currents that could dramatically improve forecasts of climate, ecosystem changes. An international collaborative of scientists led by Peter Niiler, a physical oceanographer at Scripps Institution of Oceanography, UC San Diego, and Nikolai Maximenko, a researcher at the International Pacific Research Center, University of Hawaii, has detected the presence of crisscrossing patterns of currents running throughout the world's oceans. The new data could help scientists significantly improve high-resolution models that help them understand trends in climate and marine ecosystems.

The basic dimensions of these steady patterns called striations have slowly been revealed over the course of several research papers by Niiler, Maximenko and colleagues. An analysis by Maximenko, Niiler and colleagues appearing today in the journal *Geophysical Research Letters* has produced the clearest representation of these striated patterns in the eastern Pacific Ocean to date and revealed that these complex patterns of currents extend from the surface to at least depths of 700 meters (2,300 feet). The discovery of similarly detailed patterns around the world is expected to emerge from future research.

Niiler credits the long-term and comprehensive ocean current measurements made over more than 20 years by the Global Drifter Program, now a network of more than 1,300 drifting buoys designed by him and administered by the National Oceanic and Atmospheric Administration (NOAA) for detecting these new current patterns on a global basis. Niiler added that the foresight of the University of California to provide long-term support to scientists was crucial to the discovery.

"I'm most grateful to the University of California for helping to support the invention and the 20-year maintenance of a comprehensive program of ocean circulation measurements," he said. "Scripps Institution of Oceanography is unique because of its commitment to long-term observations of the climate. Instrumental measurements of the ocean are fundamental to the definition of the state of the climate today and improvement of its prediction into the future."

In portions of the Southern Ocean, these striations-also known as ocean fronts-produce alternating eastward and westward accelerations of circulation and portions of them nearly circumnavigate Antarctica. These striations also delineate the ocean regions where uptake of carbon dioxide is greatest. In



the Atlantic Ocean, these flows bear a strong association to the Azores Current along which water flowing south from the North Atlantic circulation is being subducted. The spatial high-resolution view of the linkage between the striations and the larger scale patterns of currents could improve predictions of ocean temperatures and hurricane paths.

In addition, the striations are connected to important ecosystems like the California and Peru-Chile current systems. Off California, the striations are linked to the steady east-west displacements, or meanders, of the California Current, a major flow that runs from the border of Washington and Oregon to the southern tip of Baja California. The striations run nearly perpendicular to the California Current and continue southwestward to the Hawaiian Islands.

Niiler said there are a number of scientists who have theorized the existence of striations in the ocean. He was the first to formulate such a theory as a postdoctoral researcher at Harvard University in 1965. Niiler's theory today is that the steady-state striations in the eastern North Pacific are caused by the angular momentum of the swirling eddies within the California Current System.

A worldwide crisscrossing pattern of ocean current striations has been revealed through measurements made by drifting buoys over a period of more than 20 years and through satellite readings of ocean velocity. Blue bands represent westward-flowing currents and red bands indicate eastward-flowing currents that move at roughly 1 centimeter per second. Image courtesy of Nikolai Maximenko, University of Hawaii.

The new maps of ocean circulation produced by a combination of drifter and satellite measurements will eventually be the yardstick for judging the accuracy of the circulation patterns portrayed by climate and ocean ecosystem models -a major deficiency in current simulations-and to generate substantially more reliable forecast products in climate and ecosystem management. Niiler noted, for example, that there are a large number of computer models that can simulate equatorial currents, but fail in the attempt to accurately simulate the meandering flow of the California Current and the striations that exude from it.

"I think this research presents the next challenge in ocean modeling," said Niiler. "I'm looking forward to the day when we can correctly portray most ocean circulation systems with all climate and ecosystem models."

Maximenko said the clear resolution of the subtle striations would not have been possible without the use of data from both the drifters and satellites.

"Our finding was so unbelievable that our first proposal submitted to the National Science Foundation failed miserably because most reviewers said 'You cannot study what does not exist,'" Maximenko said. "The striations are like ghosts. To see them one needs to believe in them. No doubt, armed with our hint, scientists will start finding all kinds of striations all around the world."

Maximenko, Niiler and their international colleagues are now writing a series of papers that reveal new details about the crisscross patterns and their ties to currents such as the Kuroshio, which flows in western Pacific Ocean waters near Japan.

NOAA, the National Science Foundation, the NASA Ocean Surface Topography Team, and the Japan Agency for Marine-Earth Science and Technology supported the research.

*Adapted from materials provided by University of California - San Diego.*

<http://www.sciencedaily.com:80/releases/2008/04/080425095207.htm>



## Cancer Immunotherapy Reduces Risk Of Relapse After Surgery, Study Shows

ScienceDaily (Apr. 26, 2008) — New, long-term results from a clinical trial presented today at the 1st European Lung Cancer Conference jointly organized by the European Society for Medical Oncology (ESMO) and the International Association of the Study of Lung Cancer (IASLC) show that MAGE-A3 ASCI (Antigen-Specific Cancer Immunotherapeutic), an immune-boosting treatment for lung cancer patients, reduces the risk of relapse after surgery -- to the same extent as chemotherapy but without the side-effects of chemotherapy.

Prof. Johan Vansteenkiste from University Hospital Gasthuisberg in Belgium described the results after 44-months follow-up from a double-blind, placebo-controlled trial in 182 patients with non-small-cell lung cancer -- the most common form of the disease.

After complete surgical resection of the tumor, patients were randomly assigned to receive either placebo injections or injections of MAGE-A3 ASCI administered over 27 months (five given at three-week intervals followed by eight given once every three months). MAGE-A3 is a tumor-specific antigen, expressed in 35-50% of non-small-cell lung cancer, but not on normal cells.

"The aim is to help the body immune system to recognize the MAGE-A3 antigen and therefore eliminate the cancer cells that express MAGE-A3," explains Prof. Vansteenkiste. "In other words, it is a kind of treatment method that makes the body immune system specifically attack the lung cancer cells."

After 44 months, 69 of 182 patients had experienced a recurrence of their cancer, including 57 deaths. Those given the MAGE-A3 injections had longer on average before their cancer recurred, were less likely to have any recurrence, and were less likely to die.

"Surgical resection is the standard treatment for patients with early stage lung cancer, but after complete resection about 50% will relapse and die from their cancer," says Prof. Vansteenkiste. "Postoperative chemotherapy is able to improve cure rates, but is sometimes poorly tolerated by patients recovering from thoracic surgery. In addition, not all patients are fit to receive chemotherapy. This is why the signal from this phase II randomized study is important: the reduction in risk of postoperative cancer relapse is similar to the one obtained with postoperative chemotherapy, while the side-effects of this new strategy are minimal compared to chemotherapy."

Most patients only experience mild reactions at the injection site and fever within 24 hours of the injection, he explained. "Therefore, it is suitable for long-term maintenance treatment and for most patients, including older patients or patients in weak physical condition after surgery, allowing them to live a normal life whilst on cancer treatment." A large Phase III trial of the therapy, named MAGRIT, is now underway.

*Adapted from materials provided by European Society for Medical Oncology, via EurekAlert!, a service of AAAS.*

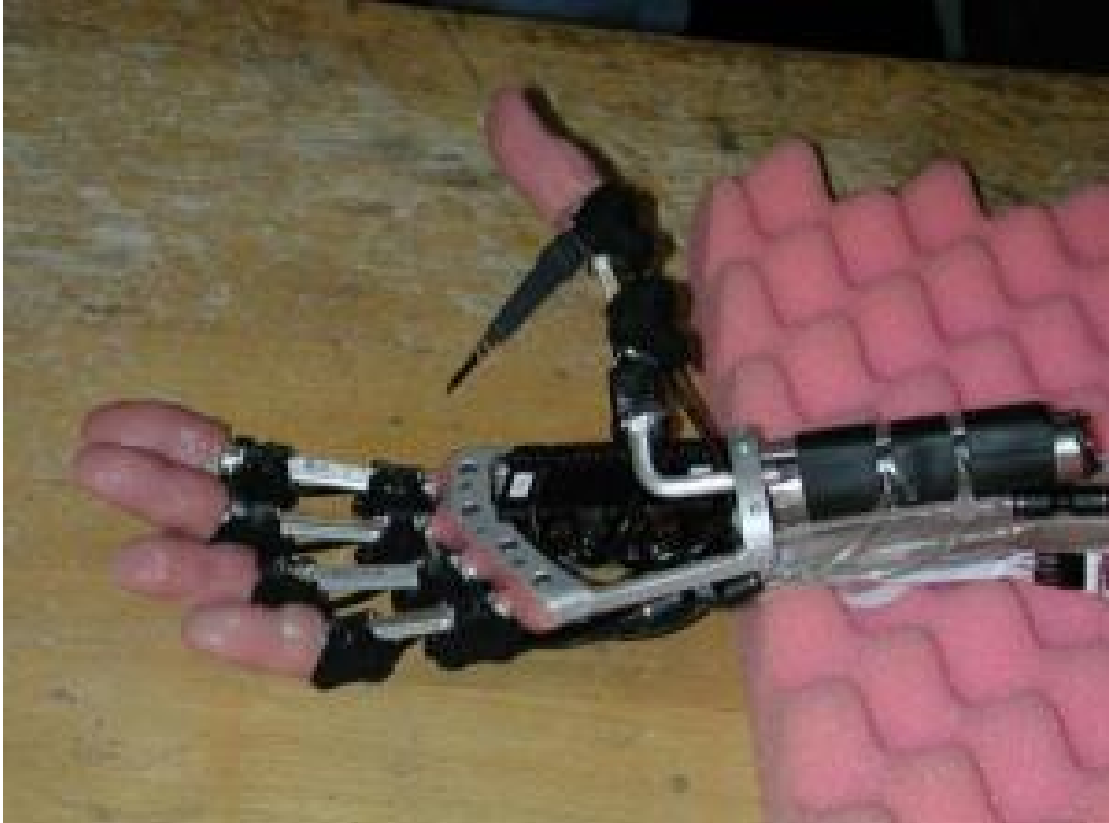
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## New Prosthetic Hand Has Grip Function Almost Like A Natural Hand: Each Finger Moves Separately

 [enlarge](#)



*Prototype of the "Fluidhand" of the Research Center in Karlsruhe. (Credit: Orthopedic University Hospital in Heidelberg)*

ScienceDaily (Apr. 25, 2008) — It can hold a credit card, use a keyboard with the index finger, and lift a bag weighing up to 20 kg – the world's first commercially available prosthetic hand that can move each finger separately and has an astounding range of grip configurations. For the first time worldwide a patient at the Orthopedic University Hospital in Heidelberg has tested both the "i-LIMB" hand in comparison with another innovative prosthesis, the so called "Fluidhand". Eighteen-year-old Sören Wolf, who was born with only one hand, is enthusiastic about its capabilities.

The new prosthetic hand developed and distributed by the Scottish company "Touch Bionics" certainly has advantages over previous models. For example, a comparable standard product from another manufacturer allows only a pinch grip using thumb, index, and middle finger, and not a grip using all five fingers. This does not allow a full-wrap grip of an object.

### **Myoelectric signals from the stump of the arm control the prosthesis**

Complex electronics and five motors contained in the fingers enable every digit of the i-LIMB to be powered individually. A passive positioning of the thumb enables various grip configurations to be activated. The myoelectric signals from the stump control the prosthetic hand; muscle signals are picked up by electrodes on the skin and transferred to the control electronics in the prosthetic hand. Batteries provide the necessary power.



The “Fluidhand” from Karlsruhe, thus far developed only as a prototype that is also being tested in the Orthopedic University Hospital in Heidelberg, is based on a somewhat different principle. Unlike its predecessors, the new hand can close around objects, even those with irregular surfaces. A large contact surface and soft, passive form elements greatly reduce the gripping power required to hold onto such an object. The hand also feels softer, more elastic, and more natural than conventional hard prosthetic devices.

### **"Fluidhand" prosthetic device offers better finishing and better grip function**

The flexible drives are located directly in the movable finger joints and operate on the biological principle of the spider leg – to flex the joints, elastic chambers are pumped up by miniature hydraulics. In this way, index finger, middle finger and thumb can be moved independently. The prosthetic hand gives the stump feedback, enabling the amputee to sense the strength of the grip.

Thus far, Sören has been the only patient in Heidelberg who has tested both models. “This experience is very important for us,” says Simon Steffen, Director of the Department of Upper Extremities at the Orthopedic University Hospital in Heidelberg. The two new models were the best of those tested, with a slight advantage for Fluidhand because of its better finishing, the programmed grip configurations, power feedback, and the more easily adjustable controls. However, this prosthetic device is not in serial production. “First the developers have to find a company to produce it,” says Alfons Fuchs, Director of Orthopedics Engineering at the Orthopedic University Hospital in Heidelberg, as the costs of manufacturing it are comparatively high. However it is possible to produce an individual model. Thus far, only one patient in the world has received a Fluidhand for every-day use. A second patient will soon be fitted with this innovative prosthesis in Heidelberg.

*Adapted from materials provided by University Hospital Heidelberg.*

<http://www.sciencedaily.com:80/releases/2008/04/080422112942.htm>



## Volcanic Eruption Of 1600 Caused Global Disruption

ScienceDaily (Apr. 25, 2008) — The 1600 eruption of Huaynaputina in Peru had a global impact on human society, according to a new study of contemporary records by geologists at UC Davis.

The eruption is known to have put a large amount of sulfur into the atmosphere, and tree ring studies show that 1601 was a cold year, but no one had looked at the agricultural and social impacts, said Ken Verosub, professor of geology at UC Davis.

"We knew it was a big eruption, we knew it was a cold year, and that's all we knew," Verosub said.

Sulfur reacts with water in the air to form droplets of sulfuric acid, which cool the planet by reducing the amount of sunlight reaching the Earth's surface. But the droplets soon fall back to Earth, so the cooling effects last only a year or so.

Verosub and undergraduate student Jake Lippmann combed through records from the turn of the 17th century from Europe, China and Japan, as well as the Spanish and Portuguese colonies in South America and the Philippines, for information about changes in climate, agriculture and society.

In Russia, 1601-1603 brought the worst famine in the country's history, leading to the overthrow of the reigning tsar. Records from Switzerland, Latvia and Estonia record exceptionally cold winters in 1600-1602; in France, the 1601 wine harvest was late, and wine production collapsed in Germany and colonial Peru. In China, peach trees bloomed late, and Lake Suwa in Japan had one of its earliest freezing dates in 500 years.

"In one sense, we can't prove that the volcano was responsible for all this," Verosub said. "But we hope to show that 1601 was a consistently bad year, connected by this event."

The previous major eruption that might have affected global climate was in 1452-53, when records were much less complete: in Europe, people began to take more careful note of the natural world after the Renaissance. The 1815 Tambora eruption in Indonesia had a well-documented impact on global agriculture, so such eruptions may occur as often as every 200 years, Verosub noted.

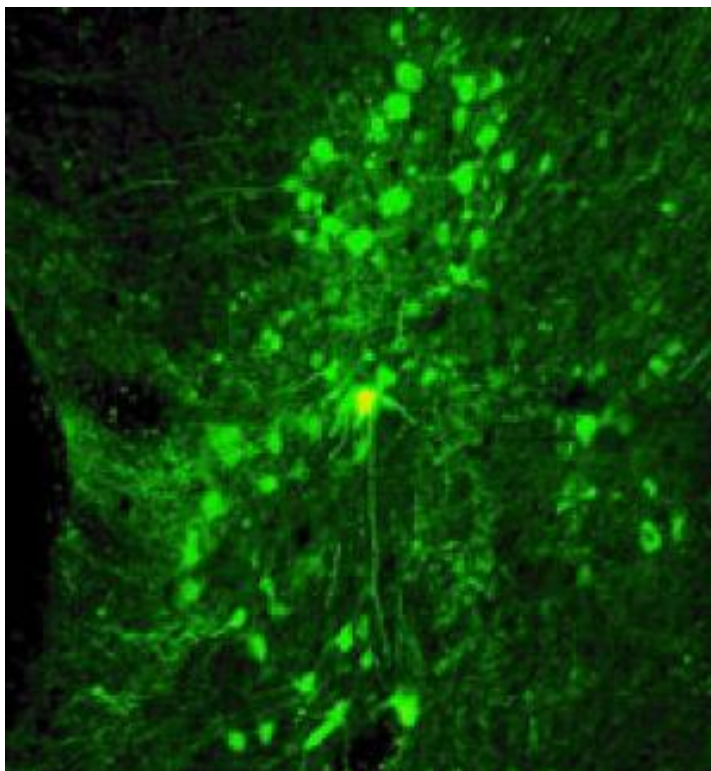
Verosub hopes to expand the study by examining records kept by the Jesuit order in Seville, Spain, and from the Ming Dynasty in China.

The initial results are presented in an article in *Eos*, the transactions of the American Geophysical Union.

*Adapted from materials provided by [University of California - Davis](#).*

<http://www.sciencedaily.com:80/releases/2008/04/080423135236.htm>

## Major Step Forward In Understanding How Memory Works



*A single neuron (centre) in the perirhinal cortex which is involved in memory processes. (Credit: Photo by Andy Doherty)*

ScienceDaily (Apr. 25, 2008) — Our ability to remember the objects, places and people within our environment is essential for everyday life, although the importance of this is only fully appreciated when recognition memory beings to fail, as in Alzheimer's disease.

By blocking certain mechanisms that control the way that nerve cells in the brain communicate, scientists from the University of Bristol have been able to prevent visual recognition memory in rats.

This demonstrates they have identified cellular and molecular mechanisms in the brain that may provide a key to understanding processes of recognition memory.

Zafar Bashir, Professor of Cellular Neuroscience, who led the team at Bristol University said: "This is a major step forward in our understanding of recognition memory. We have been able to show that key processes controlling synaptic communication are also vital in learning and memory."

The ability to recognise elements in the surrounding environment such as faces or places, as well as the ability to learn about that environment, is crucial to our normal functioning in the world. But the actual mechanisms and changes that occur in the brain and allow learning to happen are still not very well understood.

One hypothesis is that changes at the specialised junctions (synapses) between nerve cells in the brain, hold the secrets to learning and memory. The change in the strength of communication between synapses is called synaptic plasticity and, it is believed, the mechanisms of synaptic plasticity may be important for learning and memory. Bashir and his colleagues tested this hypothesis.



Dr Sarah Griffiths, lead author on the paper, explained: "Nerve cells in the perirhinal cortex of the brain are known to be vital for visual recognition memory. Using a combination of biological techniques and behavioural testing, we examined whether the mechanisms involved in synaptic plasticity are also vital for visual recognition memory."

In their experiments, they were able to identify a key molecular mechanism that controls synaptic plasticity in the perirhinal cortex. They then demonstrated that blocking the same molecular mechanism that controls synaptic plasticity also prevented visual recognition memory in rats. This shows that such memory relies on specific molecular processes in the brain.

Professor Bashir added: "The next step is to try to understand the processes that enable visual memories to be held in our brains for such long periods of time, and why these mechanisms begin to break down in old age."

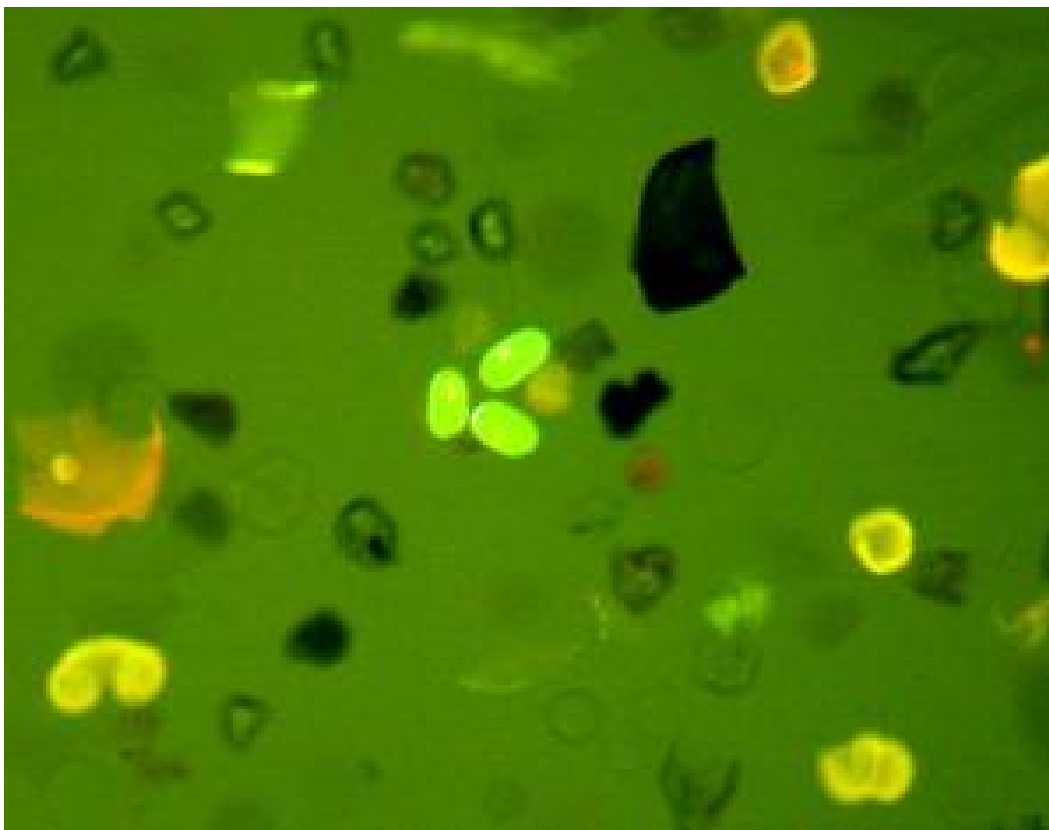
The research is published online April 23 in Neuron.

*Adapted from materials provided by University of Bristol.*

<http://www.sciencedaily.com:80/releases/2008/04/080423121427.htm>



## Significant 'Red Tide' Season Predicted For 2008 Based On Computer Models And Observations



*Stained with primulin dye and viewed under a microscope, cysts of *Alexandrium fundyense* and *Alexandrium tamarense* stand out in yellow and bright green from organic matter and sediments collected from the Gulf of Maine. (Credit: Photo by Kerry Norton, Woods Hole Oceanographic Institution)*

ScienceDaily (Apr. 25, 2008) — The end of April usually brings the first signs of harmful algae in New England waters, and this year, researchers from the Woods Hole Oceanographic Institution (WHOI) and North Carolina State University (NC State) are preparing for a potentially big bloom.

A combination of abundant beds of algal seeds and excess winter precipitation have set the stage for a harmful algal bloom similar to the historic "red tide" of 2005, according to researchers from WHOI and NC State. The 2005 bloom shut down shellfish beds from the Bay of Fundy to Martha's Vineyard for several months and caused an estimated \$50 million in losses to the Massachusetts shellfish industry alone. The weather patterns over the next few weeks will determine whether this year's algal growth approaches the troubles of 2005.

The research team--led by WHOI senior scientists Don Anderson and Dennis McGillicuddy and physical oceanographer Ruoying He of NC State--is several years into the development of a computer model to predict the intensity and location of blooms the toxic algae *Alexandrium fundyense* in the Gulf of Maine. Though the scientists are reluctant to make an official "forecast" until they can further test their models, colleagues in coastal management and fisheries believe the seasonal forecasting model can already serve as a useful tool for preparing the seafood industry for contingencies.

"With advance warning of a potentially troublesome year for algae, shellfish farmers and fishermen might shift the timing of their harvest or postpone plans for expansion of aquaculture beds," said Anderson, director of the WHOI Coastal Ocean Institute. "Restaurants might make contingency plans for supplies of



seafood during the summer, and state agencies can ensure they have adequate staff for the significant monitoring efforts that might be required to protect public health and the shellfish industry."

Seeds or "cysts" of *A. fundyense* naturally germinate and turn into swimming cells that rise from the seafloor around April 1 of each year. By the end of April, cells usually begin to appear in large numbers in the waters off coastal Maine. The algae are notorious for producing a toxin that accumulates in clams, mussels, and other shellfish and can cause paralytic shellfish poisoning (PSP) in humans who consume them.

According to a seafloor survey conducted in the fall of 2007 by Anderson's team, the number of Alexandrium cysts--the dormant, seed-like stage of the algae's life-cycle--is more than 30 percent higher than what was observed in the sediments prior to the historic bloom of 2005. The seed beds were especially rich in mid-coast Maine, origin of many of the cells that affect western Maine, New Hampshire, and Massachusetts.

Other environmental factors then determine the extent to which the blooms spread down the New England coast. Much of the Northeastern United States was hit with record- or above-average rain and snowfall this winter, which will provide an extra pulse of fresh water and nutrients into coastal waters this spring. The blend of nutrients and fresh water into salty sea water can improve growing conditions for the algae.

"Our hypothesis is that cyst abundance and the weather determines the bloom season," said McGillicuddy, a biological oceanographer in the WHOI Department of Applied Ocean Physics and Engineering. "Will the conditions this spring lead to an extensive bloom along the New England coast? The wind patterns of the next few weeks will determine that."

The research team has run its computer model through four scenarios, using the predominant wind patterns from each year since 2004. Toxicity levels during those years have ranged from little to nothing in the western Gulf of Maine (2004 and 2007), to extremely high levels (2005 and 2006). Blooms were worst for scenarios in which the spring weather was dominated by strong northeast winds, which tend to drive Alexandrium cells toward the southern New England coast. When southwesterlies dominated, the algae tend to stay offshore. Even when there are a lot of cells and toxicity, the effect can be confined to offshore waters.

Anderson, McGillicuddy and He distribute observations and data-driven models once per week with more than 80 coastal resource and fisheries managers in six states and at the National Oceanic and Atmospheric Administration, the Environmental Protection Agency, and the Food and Drug Administration (which oversees food safety).

McGillicuddy and more than a dozen students, technicians, and biologists will depart from Woods Hole on April 28 on the research vessel *Oceanus* on the first of four expeditions to take stock of this year's bloom and to study the causes of several recent blooms in the historically fertile fishing grounds around Georges Bank. Biologists and oceanographers were surprised by the substantial scale and persistence of Alexandrium blooms discovered on Georges Bank last year.

The research into harmful algal blooms is supported by NOAA's Center for Sponsored Coastal Ocean Research, and the National Institutes of Health and the National Science Foundation (through the Woods Hole Center for Oceans and Human Health). Additional work examining other species of toxic algae in the Gulf and on Georges Bank is supported by the NOAA Oceans and Human Health Initiative (OHHI).

*Adapted from materials provided by Woods Hole Oceanographic Institution.*

<http://www.sciencedaily.com:80/releases/2008/04/080424165309.htm>



## New Nanotechnology Products Hitting The Market At The Rate Of 3-4 Per Week



*Nano Silver Toothpaste, purchased in a store in Washington D.C. (Credit: 2008 - Alex Parlini, Project on Emerging Nanotechnologies)*

ScienceDaily (Apr. 25, 2008) — New nanotechnology consumer products are coming on the market at the rate of 3-4 per week, a finding based on the latest update to the nanotechnology consumer product inventory maintained by the Project on Emerging Nanotechnologies (PEN).

One of the new items among the more than 600 products now in the inventory is Swissdent Nanowhiting Toothpaste with "calcium peroxides, in the form of nano-particles." Today, in testimony before the Senate Commerce Committee, PEN Project Director David Rejeski cited Ace Silver Plus--another of the nine nano toothpastes in the inventory--as an example of the upsurge in nanotechnology consumer products in stores. The hearing marks the start of U.S. Senate debate on the future direction of the annual \$1.5 billion federal investment in nanotechnology research and development (R&D).

The number of consumer products using nanotechnology has grown from 212 to 609 since PEN launched the world's first online inventory of manufacturer-identified nanotech goods in March 2006. Health and fitness items, which includes cosmetics and sunscreens, represent 60 percent of inventory products.

There are 35 automotive products in the PEN inventory, including the Hummer H2. General Motors Corporation bills the H2 as having a cargo bed that "uses about seven pounds of molded in color nanocomposite parts for its trim, center bridge, sail panel and box rail protector."





Nanoscale silver is the most cited nanomaterial used. It is found in 143 products or over 20 percent of the inventory. Carbon, including carbon nanotubes and fullerenes, is the second highest nanoscale material cited. Other nanoscale materials explicitly referenced in products are zinc (including zinc oxide) and titanium (including titanium dioxide), silica and gold.

While polls show most Americans know little or nothing about nanotechnology, in 2006 nanotechnology was incorporated into more than \$50 billion in manufactured goods. By 2014, Lux Research estimates \$2.6 trillion in manufactured goods will incorporate nanotechnology--or about 15 percent of total global output. Despite a 2006 worldwide investment of \$12.4 billion in nanotech R&D, comparatively little was spent on examining nanotechnology's potential environmental, health and safety risks.

"Public trust is the 'dark horse' in nanotechnology's future," says Rejeski in his testimony. "If government and industry do not work to build public confidence in nanotechnology, consumers may reach for the 'No-Nano' label in the future and investors will put their money elsewhere."

According to Rejeski, "The use of nanotechnology in consumer products and industrial applications is growing rapidly, with the products listed in the PEN inventory showing just the tip of the iceberg. Public perceptions about risks--real and perceived--can have large economic consequences. How consumers respond to these early products--in food, electronics, health care, clothing and cars--is a litmus test for broader market acceptance of nanotechnologies in the future."

A list of nanotechnology merchandise--containing everything from nanotech diamonds and cooking oil, to golf clubs and iPhones--is available at <http://www.nanotechproject.org/consumerproducts>.

*Adapted from materials provided by Project on Emerging Nanotechnologies, via EurekAlert!, a service of AAAS.*

<http://www.sciencedaily.com:80/releases/2008/04/080424102505.htm>





## Concrete Examples Don't Help Students Learn Math, Study Finds

ScienceDaily (Apr. 25, 2008) — A new study challenges the common practice in many classrooms of teaching mathematical concepts by using "real-world," concrete examples. Researchers led by Jennifer Kaminski, researcher scientist at Ohio State University's Center for Cognitive Science, found that college students who learned a mathematical concept with concrete examples couldn't apply that knowledge to new situations.

But when students first learned the concept with abstract symbols, they were much more likely to transfer that knowledge, according to the study published in the April 25 issue of the journal *Science*.

"These findings cast doubt on a long-standing belief in education," said Vladimir Sloutsky, co-author of the study and professor of psychology and human development and the director of the Center for Cognitive Science at Ohio State.

"The belief in using concrete examples is very deeply ingrained, and hasn't been questioned or tested."

Kaminski and Sloutsky conducted the study with Andrew Heckler, assistant professor of physics at Ohio State.

Teachers often use real-world examples in math class, the researchers said. In some classrooms, for example, teachers may explain probability by pulling a marble out of a bag of red and blue marbles and determining how likely it will be one color or the other.

But students may learn better if teachers explain the concept as the probability of choosing one of  $n$  things from a larger set of  $m$  things, Kaminski said.

The issue can also be seen in the story problems that math students are often given, she explained. For example, there is the classic problem of two trains that leave different cities heading toward each other at different speeds. Students are asked to figure out when the two trains will meet.

"The danger with teaching using this example is that many students only learn how to solve the problem with the trains," Kaminski said.

"If students are later given a problem using the same mathematical principles, but about rising water levels instead of trains, that knowledge just doesn't seem to transfer," she said.

"It is very difficult to extract mathematical principles from story problems," Sloutsky added. "Story problems could be an incredible instrument for testing what was learned. But they are bad instruments for teaching."

In the research presented in *Science*, the researchers did several separate experiments that examined how well undergraduate students learned a simple mathematical concept under different conditions. The concept involved basic mathematical properties such as commutativity and associativity -- the fact that you can change the order of elements without changing the results. For instance,  $3+2$  and  $2+3$  both equal 5.

In the various experiments, some students learned these principles using generic symbols, in which combinations of two or more symbols resulted in a predictable resulting symbol.

Others were presented with one or more concrete examples that involved this same concept. In one concrete example, students viewed three images of measuring cups with varying levels of liquid.



Participants were told they needed to determine the remaining amount when different cups of liquid were combined.

Two other concrete examples were used in various experiments -- one involving how many slices of pizza in a pizza pie were overcooked, and one involving how many tennis balls were in a container.

After learning this math concept using the concrete examples or abstract, generic symbols, the students took a multiple-choice quiz demonstrating that they learned the principles involved. And in all cases, the study showed that most undergraduate students picked up the knowledge easily.

However, the true test came later when the researchers asked these students to apply the same principles in a totally different setting, which was described to them as a children's game from another country. The rules of this game followed the principles which they had just learned. The researchers calculated how well the participants did on a multiple choice test involving the rules of that children's game.

In the first experiment, involving 80 students, some participants were given one concrete example before testing on the children's game, while some were given two or three examples. One group only learned the generic symbols.

When tested on the children's game, the group that learned the generic symbols got nearly 80 percent of the questions right. Those who learned one, two or even three concrete examples did no better than chance in selecting the right answers.

"They were just guessing," Kaminski said.

In a second experiment, the researchers gave 20 participants two concrete examples and explained how they were alike. Surprisingly, this still did not help students apply the concept any better and they still did no better than chance when tested later about the game.

In a third experiment, the researchers presented 20 students with two concrete examples and then asked them to compare the two examples and write down any similarities they saw. After this experiment, about 44 percent of the students performed well on the test concerning the children's game, while the remainder still did not perform better than chance.

This suggests that only some students, not all, benefit from direct comparison of learned concrete examples.

Finally, in a fourth experiment involving 40 students, some learned the concrete example first followed by the generic symbols, while others learned only the generic symbols. The thought here was that the concrete example would engage the students in the learning process while the generic symbols would promote transfer of that knowledge.

But even in this experiment, students who learned only the generic symbols performed better on subsequent testing than those who learned the concept using the concrete example and then the generic symbols.

The authors said that students seem to learn concepts quickly when they are presented with familiar real objects such as marbles or containers of liquid, and so it is easy to see why many advocate this approach. "But it turns out there is no true insight there. They can't move beyond these real objects to apply that knowledge," said Sloutsky.

The problem may be that extraneous information about marbles or containers might divert attention from the real mathematics behind it all, according to Kaminski.



"We really need to strip these concepts down to very symbolic representations such as variables and numbers," she said. "Then students are better prepared to apply those concepts in a variety of situations.

The authors said they doubt this paper will end the debate over approaches to teaching mathematics, but they hope it will generate interest into systematic examination of which ways of teaching mathematics are most effective.

*Adapted from materials provided by Ohio State University, via EurekAlert!, a service of AAAS.*

<http://www.sciencedaily.com:80/releases/2008/04/080424140410.htm>



## Blocking the Transmission of Violence

By ALEX KOTLOWITZ



LAST SUMMER, MARTIN TORRES WAS WORKING AS A COOK IN AUSTIN, Tex., when, on the morning of Aug. 23, he received a call from a relative. His 17-year-old nephew, Emilio, had been murdered. According to the police, Emilio was walking down a street on Chicago's South Side when someone shot him in the chest, possibly the culmination of an ongoing dispute. Like many killings, Emilio's received just a few sentences in the local newspapers. Torres, who was especially close to his nephew, got on the first Greyhound bus to Chicago. He was grieving and plotting retribution. "I thought, Man, I'm going to take care of business," he told me recently. "That's how I live. I was going hunting. This is my own blood, my nephew."

Torres, who is 38, grew up in a dicey section of Chicago, and even by the standards of his neighborhood he was a rough character. His nickname was Packman, because he was known to always pack a gun. He was first shot when he was 12, in the legs with buckshot by members of a rival gang. He was shot five more times, including once through the jaw, another time in his right shoulder and the last time — seven years ago — in his right thigh, with a .38-caliber bullet that is still lodged there. On his chest, he has tattooed a tombstone with the name "Buff" at its center, a tribute to a friend who was killed on his 18th birthday. Torres was the head of a small Hispanic gang, and though he is no longer active, he still wears two silver studs in his left ear, a sign of his affiliation.

When he arrived in Chicago, he began to ask around, and within a day believed he had figured out who killed his nephew. He also began drinking a lot — mostly Hennessy cognac. He borrowed two guns, a .38 and a .380, from guys he knew. He would, he thought, wait until after the funeral to track down his nephew's assailants.



Zale Hoddenbach looks like an ex-military man. He wears his hair cropped and has a trimmed goatee that highlights his angular jaw. He often wears T-shirts that fit tightly around his muscled arms, though he also carries a slight paunch. When he was younger, Hoddenbach, who is also 38, belonged to a gang that was under the same umbrella as Torres's, and so when the two men first met 17 years ago at Pontiac Correctional Center, an Illinois maximum-security prison, they became friendly. Hoddenbach was serving time for armed violence; Torres for possession of a stolen car and a gun (he was, he says, on his way to make a hit). "Zale was always in segregation, in the hole for fights," Torres told me. "He was aggressive." In one scuffle, Hoddenbach lost the sight in his right eye after an inmate pierced it with a shank. Torres and Hoddenbach were at Pontiac together for about a year but quickly lost touch after they were both released.

Shortly after Torres arrived in Chicago last summer, Hoddenbach received a phone call from Torres's brother, the father of the young man who was murdered. He was worried that Torres was preparing to seek revenge and hoped that Hoddenbach would speak with him. When Hoddenbach called, Torres was thrilled. He immediately thought that his old prison buddy was going to join him in his search for the killer. But instead Hoddenbach tried to talk him down, telling him retribution wasn't what his brother wanted. "I didn't understand what the hell he was talking about," Torres told me when I talked to him six months later. "This didn't seem like the person I knew." The next day Hoddenbach appeared at the wake, which was held at New Life Community Church, housed in a low-slung former factory. He spent the day by Torres's side, sitting with him, talking to him, urging him to respect his brother's wishes. When Torres went to the parking lot for a smoke, his hands shaking from agitation, Hoddenbach would follow. "Because of our relationship, I thought there was a chance," Hoddenbach told me. "We were both cut from the same cloth." Hoddenbach knew from experience that the longer he could delay Torres from heading out, the more chance he'd have of keeping him from shooting someone. So he let him vent for a few hours. Then Hoddenbach started laying into him with every argument he could think of: Look around, do you see any old guys here? I never seen so many young kids at a funeral. Look at these kids, what does the future hold for them? Where do we fit in? Who are you to step on your brother's wishes?

THE STUBBORN CORE of violence in American cities is troubling and perplexing. Even as homicide rates have declined across the country — in some places, like New York, by a remarkable amount — gunplay continues to plague economically struggling minority communities. For 25 years, murder has been the leading cause of death among African-American men between the ages of 15 and 34, according to the [Centers for Disease Control and Prevention](#), which has analyzed data up to 2005. And the past few years have seen an uptick in homicides in many cities. Since 2004, for instance, they are up 19 percent in Philadelphia and Milwaukee, 29 percent in Houston and 54 percent in Oakland. Just two weekends ago in Chicago, with the first warm weather, 36 people were shot, 7 of them fatally. The Chicago Sun-Times called it the "weekend of rage." Many killings are attributed to gang conflicts and are confined to particular neighborhoods. In Chicago, where on average five people were shot each day last year, 83 percent of the assaults were concentrated in half the police districts. So for people living outside those neighborhoods, the frequent outbursts of unrestrained anger have been easy to ignore. But each shooting, each murder, leaves a devastating legacy, and a growing school of thought suggests that there's little we can do about the entrenched urban poverty if the relentless pattern of street violence isn't somehow broken.

The traditional response has been more focused policing and longer prison sentences, but law enforcement does little to disrupt a street code that allows, if not encourages, the settling of squabbles with deadly force. Zale Hoddenbach, who works for an organization called CeaseFire, is part of an unusual effort to apply the principles of public health to the brutality of the streets. CeaseFire tries to deal with these quarrels on the front end. Hoddenbach's job is to suss out smoldering disputes and to intervene before matters get out of hand. His job title is violence interrupter, a term that while not artful seems bluntly self-explanatory. Newspaper accounts usually refer to the organization as a gang-intervention program, and Hoddenbach and most of his colleagues are indeed former gang leaders. But CeaseFire doesn't necessarily aim to get people out of gangs — nor interrupt the drug trade. It's almost blindly focused on one thing: preventing shootings.

CeaseFire's founder, Gary Slutkin, is an epidemiologist and a physician who for 10 years battled infectious diseases in Africa. He says that violence directly mimics infections like tuberculosis and AIDS, and so, he suggests, the treatment ought to mimic the regimen applied to these diseases: go after the most infected, and stop the infection at its source. "For violence, we're trying to interrupt the next event, the next transmission, the next violent activity," Slutkin told me recently. "And the violent activity predicts the next violent activity like H.I.V. predicts the next H.I.V. and TB predicts the next TB." Slutkin wants to shift how we think about violence from a moral issue (good and bad people) to a public health one (healthful and unhealthful behavior).

EVERY WEDNESDAY AFTERNOON, in a Spartan room on the 10th floor of the University of Illinois at Chicago's public-health building, 15 to 25 men — and two women — all violence interrupters, sit around tables arranged in a circle and ruminate on the rage percolating in the city. Most are in their 40s and 50s, though some, like Hoddenbach, are a bit younger. All of them are black or Hispanic and in one manner or another have themselves been privy to, if not participants in, the brutality of the streets.



On a Wednesday near the end of March, Slutkin made a rare appearance; he ordinarily leaves the day-to-day operations to a staff member. Fit at 57, Slutkin has a somewhat disheveled appearance — tie askew, hair uncombed, seemingly forgetful. Some see his presentation as a calculated effort to disarm. "Slutkin does his thing in his Slutkinesque way," notes Carl Bell, a psychiatrist who has long worked with children exposed to neighborhood violence and who admires CeaseFire's work. "He seems kind of disorganized, but he's not." Hoddenbach told me: "You can't make too much of that guy. In the beginning, he gives you that look like he doesn't know what you're talking about."

Slutkin had come to talk with the group about a recent high-profile incident outside Crane Tech High School on the city's West Side. An 18-year-old boy was shot and died on the school's steps, while nearby another

boy was savagely beaten with a golf club. Since the beginning of the school year, 18 Chicago public-school students had been killed. (Another six would be murdered in the coming weeks.) The interrupters told Slutkin that there was a large police presence at the school, at least temporarily muffling any hostilities there, and that the police were even escorting some kids to and from school. They then told him what was happening off the radar in their neighborhoods. There was the continuing discord at another high school involving a group of girls ("They'd argue with a stop sign," one of the interrupters noted); a 14-year-old boy with a gang tattoo on his forehead was shot by an older gang member just out of prison; a 15-year-old was shot in the stomach by a rival gang member as he came out of his house; and a former CeaseFire colleague was struggling to keep himself from losing control after his own sons were beaten. There was also a high-school basketball player shot four times; a 12-year-old boy shot at a party; gang members arming themselves to counter an egging of their freshly painted cars; and a high-ranking gang member who was on life support after being shot, and whose sister was overheard talking on her cellphone in the hospital, urging someone to "get those straps together. Get loaded."

These incidents all occurred over the previous seven days. In each of them, the interrupters had stepped in to try to keep one act of enmity from spiraling into another. Some had more success than others. Janell



Sails prodded the guys with the egged cars to go to a car wash and then persuaded them it wasn't worth risking their lives over a stupid prank. At Crane Tech High School, three of the interrupters fanned out, trying to convince the five gangs involved in the conflict to lie low, but they conceded that they were unable reach some of the main players. Many of the interrupters seem bewildered by what they see as a wilder group of youngsters now running the streets and by a gang structure that is no longer top-down but is instead made up of many small groups — which they refer to as cliques — whose members are answerable to a handful of peers.

For an hour, Slutkin leaned on the table, playing with a piece of Scotch tape, keenly listening. In some situations, Slutkin can appear detached and didactic. He can wear people down with his long discourses, and some of the interrupters say they sometimes tune him out. (On one occasion, he tried to explain to me the relationship between emotional intelligence and quantum physics.) But having seen a lot of out-of-control behavior, Slutkin is a big believer in controlling emotions. So he has taught himself not to break into discussions and to digest before presenting his view. The interrupters say he has their unqualified loyalty. Hoddenbach told me that he now considers Slutkin a friend.

It became clear as they delivered their reports that many of the interrupters were worn down. One of them, Calvin Buchanan, whose street name is Monster and who just recently joined CeaseFire, showed the others six stitches over his left eye; someone had cracked a beer bottle on his head while he was mediating an argument between two men. The other interrupters applauded when Buchanan told them that, though tempted, he restrained himself from getting even.

When Slutkin finally spoke, he first praised the interrupters for their work. "Everybody's overreacting, and you're trying to cool them down," he told them. He then asked if any of them had been experiencing jitteriness or fear. He spent the next half-hour teaching stress-reduction exercises. If they could calm themselves, he seemed to be saying, they could also calm others. I recalled what one of the interrupters told me a few weeks earlier: "We helped create the madness, and now we're trying to debug it."

IN THE PUBLIC-HEALTH field, there have long been two schools of thought on derailing violence. One focuses on environmental factors, specifically trying to limit gun purchases and making guns safer. The other tries to influence behavior by introducing school-based curricula like antidrug and safe-sex campaigns.

Slutkin is going after it in a third way — as if he were trying to contain an infectious disease. The fact that there's no vaccine or medical cure for violence doesn't dissuade him. He points out that in the early days of AIDS, there was no treatment either. In the short run, he's just trying to halt the spread of violence. In the long run, though, he says he hopes to alter behavior and what's considered socially acceptable.

Slutkin's perspective grew out of his own experience as an infectious-disease doctor. In 1981, six years out of the University of Chicago Pritzker School of Medicine, Slutkin was asked to lead the TB program in San Francisco. With an influx of new refugees from Cambodia, Laos and Vietnam, the number of cases in the city had nearly doubled. Slutkin chose to concentrate on those who had the most active TB; on average, they were infecting 6 to 10 others a year. Slutkin hired Southeast Asian outreach workers who could not only locate the infected individuals but who could also stick with them for nine months, making sure they took the necessary medication. These outreach workers knew the communities and spoke the languages, and they were able to persuade family members of infected people to be tested. Slutkin also went after the toughest cases — 26 people with drug-resistant TB. The chance of curing those people was slim, but Slutkin reckoned that if they went untreated, the disease would continue to spread. "Gary wasn't constrained by the textbook," says Eric Goosby, who worked in the clinic and is now the chief executive of the Pangaea Global AIDS Foundation. Within two years, the number of TB cases, at least among these new immigrants, declined sharply.

Slutkin then spent 10 years in Africa, first in refugee camps in Somalia and then working, in Uganda and other countries, for the World Health Organization to curtail the spread of AIDS. During his first posting, in Somalia, a cholera epidemic spread from camp to camp. Slutkin had never dealt with an outbreak of







this sort, and he was overwhelmed. The diarrhea from cholera is so severe that patients can die within hours from dehydration. According to Sandy Gove, who was then married to Slutkin and was also a doctor in the camps, infection rates were approaching 10 percent; in one camp there were 1,000 severely ill refugees. “It was desperate,” she told me. Slutkin drove a Land Cruiser two and a half days to an American military base along the coast to the closest phone. He called doctors in Europe and the United States, trying to get information. He also asked the soldiers at the base for blue food coloring, which he then poured into the water sources of the bacteria, a warning to refugees not to drink. “What Gary is really good about is laying out a broad strategic plan and keeping ahead of something,” Gove told me. There were only six doctors for the 40 refugee camps, so Slutkin and Gove trained birth attendants to spot infected people and to give them rehydration therapies in their homes. Because the birth attendants were refugees, they were trusted and could persuade those with the most severe symptoms to receive aid at the medical tent.

After leaving Africa, Slutkin returned to Chicago, where he was raised and where he could attend to his aging parents. (He later remarried there.) It was 1995, and there had been a series of horrific murders involving children in the city. He was convinced that longer sentences and more police officers had made little difference. “Punishment doesn’t drive behavior,” he told me. “Copying and modeling and the social expectations of your peers is what drives your behavior.”

Borrowing some ideas (and the name) from a successful Boston program, Slutkin initially established an approach that exists in one form or another in many cities: outreach workers tried to get youth and young adults into school or to help them find jobs. These outreach workers were also doing dispute mediation. But Slutkin was feeling his way, much as he had in Somalia during the cholera epidemic. One of Slutkin’s colleagues, Tio Hardiman, brought up an uncomfortable truth: the program wasn’t reaching the most bellicose, those most likely to pull a trigger. So in 2004, Hardiman suggested that, in addition to outreach workers, they also hire men and women who had been deep into street life, and he began recruiting people even while they were still in prison. Hardiman told me he was looking for those “right there on the edge.” (The interrupters are paid roughly \$15 an hour, and those working full time receive benefits from the University of Illinois at Chicago, where CeaseFire is housed.) The new recruits, with strong connections to the toughest communities, would focus solely on sniffing out clashes that had the potential to escalate. They would intervene in potential acts of retribution — as well as try to defuse seemingly minor spats that might erupt into something bigger, like disputes over women or insulting remarks.

As CeaseFire evolved, Slutkin says he started to realize how much it was drawing on his experiences fighting TB and AIDS. “Early intervention in TB is actually treatment of the most infectious people,” Slutkin told me recently. “They’re the ones who are infecting others. So treatment of the most infectious spreaders is the most effective strategy known and now accepted in the world.” And, he continued, you want to go after them with individuals who themselves were once either infectious spreaders or at high risk for the illness. In the case of violence, you use those who were once hard-core, once the most belligerent, once the most uncontrollable, once the angriest. They are the most convincing messengers. It’s why, for instance, Slutkin and his colleagues asked sex workers in Uganda and other nations to spread the word to other sex workers about safer sexual behavior. Then, Slutkin said, you train them, as you would paraprofessionals, as he and Gove did when they trained birth attendants to spot cholera in Somalia.

The first step to containing the spread of an infectious disease is minimizing transmission. The parallel in Slutkin’s Chicago work is thwarting retaliations, which is precisely what Hoddenbach was trying to do in the aftermath of Emilio Torres’s murder. But Slutkin is also looking for the equivalent of a cure. The way public-health doctors think of curing disease when there are no drug treatments is by changing behavior. Smoking is the most obvious example. Cigarettes are still around. And there’s no easy remedy for lung cancer or emphysema. So the best way to deal with the diseases associated with smoking is to get people to stop smoking. In Uganda, Slutkin and his colleagues tried to change behavior by encouraging people to have fewer sexual partners and to use condoms. CeaseFire has a visible public-communications campaign, which includes billboards and bumper stickers (which read, “Stop. Killing. People.”). It also holds rallies — or what it calls “responses” — at the sites of killings. But much research suggests that



peer or social pressure is the most effective way to change behavior. "It was a real turning point for me," Slutkin said, "when I was working on the AIDS epidemic and saw research findings that showed that the principal determinant of whether someone uses a condom or not is whether they think their friends use them." Daniel Webster, a professor of public health at [Johns Hopkins University](#) who has looked closely at CeaseFire, told me, "The guys out there doing the interruption have some prestige and reputation, and I think the hope is that they start to change a culture so that you can retain your status, retain your manliness and be able to walk away from events where all expectations were that you were supposed to respond with lethal force."

As a result, the interrupters operate in a netherworld between upholding the law and upholding the logic of the streets. They're not meant to be a substitute for the police, and indeed, sometimes the interrupters negotiate disputes involving illicit goings-on. They often walk a fine line between mediating and seeming to condone criminal activity. At one Wednesday meeting this past December, the interrupters argued over whether they could dissuade stickup artists from shooting their victims; persuading them to stop robbing people didn't come up in the discussion.

LAST DECEMBER, at the first Wednesday meeting I attended, James Highsmith came up to introduce himself. At 58, Highsmith is one of the older interrupters. He wears striped, collared shirts, black rectangular glasses and often a black Borsalino, an Italian-made fedora. He reminded me that I had mentioned him in my book, "There Are No Children Here," about life in a Chicago public-housing project in the late 1980s. I wrote about a picnic that some Chicago drug kingpins gave in a South Side park. There was a car show, a wet T-shirt contest and softball games for the children. About 2,000 people attended, dancing to a live band while the drug lords showed off their Mercedes Benzes, Rolls-Royces and Jaguars. Highsmith was the key sponsor of the event. He controlled the drug trade on the city's South Side. He owned a towing business, an auto-mechanic's shop and a nightclub, as well as a 38-foot boat. In January 1994, he was sentenced to 14 years in federal prison on drug-conspiracy charges; he was released in 2004. Highsmith was just the kind of recruit CeaseFire looks for: an older man getting out of the penitentiary who once had standing on the streets and who, through word of mouth, appears ready, eager even, to discard his former persona. "I'm a work in progress," Highsmith told me.

One evening we were sitting in Highsmith's basement apartment when the phone rang. It was Alphonso Prater, another interrupter. The two had a reunion of sorts when they joined CeaseFire; they shared a cell in the county jail 34 years ago. Prater's voice is so raspy it sounds as if he has gravel in his throat. He told me that he became permanently hoarse after a long stint in segregation in prison; he had to shout to talk with others. When Prater called the night I was there, all Highsmith could make out was: "There's some high-tech stuff going on. I need you to talk to some folks." Highsmith didn't ask any questions.

We drove to a poorly lighted side street on the city's West Side. Empty beer bottles littered the side of the road. Prater, who is short and wiry and has trouble keeping still, was bouncing on the sidewalk, standing next to a lanky middle-aged man who had receded into his oversize hooded sweatshirt. Highsmith, Prater and another interrupter joined the man in a parked car, where they talked for half an hour. When they were done, the car peeled away, two other sedans escorting it, one in front, the other in the rear. "Protection," Highsmith commented. Apparently, the man in the hooded sweatshirt, whom I would meet later, had been an intermediary in a drug deal. He had taken an out-of-town buyer holding \$30,000 in cash to a house on the South Side to buy drugs. But when they got there, they were met by six men in the backyard, each armed with a pistol or an automatic weapon, and robbed. The out-of-town buyer believed he'd been set up by the intermediary, who, in turn, was trying to hunt down the stickup artists. In the car, Prater, who knew the intermediary, had worked to cool him down, while Highsmith promised to see if he could find someone who might know the stickup guys and could negotiate with them. The intermediary told Prater and Highsmith, a bit ominously, "Something got to give."

After the intermediary drove off, Prater joked that there was no way he was getting back in a car with him, that he was too overheated and too likely to be the target or the shooter. "I'm not sure we can do anything about this one," Highsmith told Prater.



RELYING ON HARDENED TYPES — the ones who, as Webster of Johns Hopkins says, have some prestige on the streets — is risky. They have prestige for a reason. Hoddenbach, who once beat someone so badly he punctured his lungs, is reluctant to talk about his past. “I don’t want to be seen as a monster,” he told me. Hoddenbach’s ethnicity is hard to pinpoint. His father was Dutch and his mother Puerto Rican, and he’s so light-skinned his street name was Casper. He has a discerning gaze and mischievous smile, and can be hardheaded and impatient. (At the Wednesday meetings, he often sits near the door and whispers entreaties to the others to speed things up.) Hoddenbach’s father had an explosive temper, and to steal from Slutkin’s lingo, he seems to have infected others. Two of Hoddenbach’s older brothers are serving time for murder. His third brother has carved out a legitimate life as a manager at a manufacturing firm. Hoddenbach always worked. He did maintenance on train equipment and towed airplanes at a private airport. But he was also active in a Hispanic street gang and was known for his unmitigated aggression. He served a total of eight years in the state penitentiary, the last stay for charges that included aggravated battery. He was released in 2002.

In January, I was with Slutkin in Baltimore, where he spoke about CeaseFire to a small gathering of local civic leaders at a private home. During the two-hour meeting, Slutkin never mentioned that the interrupters were ex-felons. When I later asked him about that omission, he conceded that talking about their personal histories “is a dilemma. I haven’t solved it.” I spent many hours with Hoddenbach and the others, trying to understand how they chose to make the transition from gangster to peacemaker, how they put thuggery behind them. It is, of course, their street savvy and reputations that make them effective for CeaseFire. (One supporter of the program admiringly called it “a terrifying strategy” because of the inherent risks.) Some CeaseFire workers have, indeed, reverted to their old ways. One outreach worker was fired after he was arrested for possession of an AK-47 and a handgun. Another outreach worker and an interrupter were let go after they were arrested for dealing drugs. Word-of-mouth allegations often circulate, and privately, some in the police department worry about CeaseFire’s workers returning to their old habits.

Not all the interrupters I talked to could articulate how they had made the transition. Some, like Hoddenbach, find religion — in his case, Christianity. He also has four children he feels responsible for, and has found ways to decompress, like going for long runs. (His brother Mark speculated that “maybe he just wants to give back what he took out.”) I once asked Hoddenbach if he has ever apologized to anyone he hurt. We were with one of his old friends from the street, who started guffawing, as if I had asked Hoddenbach if he ever wore dresses. “I done it twice,” Hoddenbach told us — quickly silencing his friend and saving me from further embarrassment. (One apology was to the brother of the man whose lungs he’d punctured; the other was to a rival gang member he shot.) Alphonso Prater told me that the last time he was released from prison, in 2001, an older woman hired him to gut some homes she was renovating. She trusted him with the keys to the homes, and something about that small gesture lifted him. “She seen something in me that I didn’t see,” he told me.

Though the interrupters may not put it this way, the Wednesday meetings are a kind of therapy. One staff member laughingly compared it to a 12-step program. It was clear to me that they leaned on one another — a lot. Prater once got an urgent call from his daughter, who said her boyfriend was beating her. Prater got in his car and began to race to her house; as he was about to run a stop sign, he glimpsed a police car on the corner. He skidded to a halt. It gave him a moment to think, and he called his CeaseFire supervisor, Tio Hardiman, who got another interrupter to visit Prater’s daughter. Not long ago, three old-timers fresh out of prison ruthlessly ridiculed Hoddenbach for his work with CeaseFire. They were relentless, and Hoddenbach asked to sit down with them. But when it came time to meet, he realized he was too riled, and so he asked another interrupter, Tim White, to go in his place. “I was worried I was going to whip their asses, and wherever it went from there it went,” Hoddenbach told me. “They were old feelings, feelings I don’t want to revisit.”

Recently I went out to lunch with Hoddenbach and Torres. It had been four months since Torres buried his nephew. Torres, who looked worn and agitated (he would get up periodically to smoke a cigarette outside), seemed paradoxically both grateful to and annoyed at Hoddenbach. In the end, Hoddenbach had persuaded him not to avenge his nephew’s murder. Torres had returned the guns and quickly left town. This was his first visit back to Chicago. “I felt like a punk,” he told me, before transferring to the present





tense. “I feel shameful.” He said he had sought revenge for people who weren’t related to him — “people who weren’t even no blood to me.” But he held back in the case of his nephew. “I still struggle with it,” he said. On the ride over to the restaurant, Torres had been playing a CD of his nephew’s favorite rap songs. It got him hyped up, and he blurted out to Hoddenbach, “I feel like doing something.” Hoddenbach chided him and shut off the music. “Stop being an idiot,” he told Torres.

“Something made me do what Zale asked me to do,” Torres said later, looking more puzzled than comforted. “Which is respect my brother’s wishes.”

When Slutkin heard of Hoddenbach’s intervention, he told me: “The interrupters have to deal with how to get someone to save face. In other words, how do you not do a shooting if someone has insulted you, if all of your friends are expecting you to do that? . . . In fact, what our interrupters do is put social pressure in the other direction.”

He continued: “This is cognitive dissonance. Before Zale walked up to him, this guy was holding only one thought. So you want to put another thought in his head. It turns out talking about family is what really makes a difference.” Slutkin didn’t take this notion to the interrupters; he learned it from them.

ONE JANUARY NIGHT at 11 p.m., Charles Mack received a phone call that a shooting victim was being rushed to Advocate Christ Medical Center. Mack drove the 10 miles from his home to the hospital, which houses one of four trauma centers in Chicago. Two interrupters, Mack and LeVon Stone, are assigned there. They respond to every shooting and stabbing victim taken to the hospital. Mack, who is 57 and has a slight lisp, is less imposing than his colleagues. He seems always to be coming from or going to church, often dressed in tie and cardigan. He sheepishly told me that his prison term, two years, was for bank fraud. “The other guys laugh at me,” he said. LeVon Stone is 23 years younger and a fast talker. He’s in a wheelchair, paralyzed from the waist down as a result of being shot when he was 18.

Advocate Christ has come to see the presence of interrupters in the trauma unit as essential and is, in fact, looking to expand their numbers. “It has just given me so much hope,” Cathy Arsenault, one of the chaplains there, told me. “The families would come in, huddle in the corner and I could see them assigning people to take care of business.” Mack and Stone try to cool off family members and friends, and if the victim survives, try to keep them from seeking vengeance.

The victim that night was a tall 16-year-old boy named Frederick. He was lying on a gurney just off the emergency room’s main hallway. He was connected to two IVs, and blood was seeping through the gauze wrapped around his left hand. Mack stood to one side; Stone pulled up on the other.

“You know, the most important thing is —” Mack ventured.

“You’re alive,” Stone chimed in.

Stone then asked Frederick if he had heard of CeaseFire. The boy nodded and told them that he had even participated in a CeaseFire rally after a killing in his neighborhood.

“We try to stop violence on the front end,” Stone told Frederick. “Unfortunately, this is the back end. We just want to make sure you don’t go out and try to retaliate.”

The boy had been shot — one bullet shattered his thigh bone and another ripped the tendons in two fingers. Nonetheless, he seemed lucid and chatty.

“My intention is to get in the house, call my school, get my books and finish my work,” he told Mack and Stone. He mentioned the school he attends, which Mack instantly recognized as a place for kids on juvenile-court probation. Frederick told his story. He was at a party, and a rival clique arrived. Frederick and his friends sensed there would be trouble, so they left, and while standing outside, one of the rival



group pulled a gun on them. Frederick's friend told him earlier he had a gun. It turned out to be braggadocio, and so when his friend took off running, so did Frederick, a step behind. As he dashed through a narrow passageway between buildings, he heard the shots.

"Can I ask why you're in the wheelchair?" Frederick asked Stone.

"I got shot 15 years ago," Stone told him. Stone didn't say anything more about it, and later when I asked for more detail, he was elusive. He said simply that he had gotten shot at a barbecue when he tried to intervene in a fistfight.

"You doing good," Stone assured him. "You got shot. You're here. And you're alive. What you do when you get out of here?"

"You got to stop hanging with the wrong person, thinking you're a Wyatt Earp," Frederick said, speaking in the third person as if he were reciting a lesson.

At that point, Frederick's sister arrived. She explained that she was bringing up her brother. She was 18.

"He just wants to go to parties, parties, parties," she complained. "But it's too dangerous." She started to cry.

"Don't start that, please," Frederick pleaded.

Mack left a CeaseFire brochure on Frederick's chest and promised to visit him again in the coming weeks.

LAST MAY, after a 16-year-old boy was killed trying to protect a girl from a gunman on a city bus, Slutkin appeared on a local public-television news program. He suggested CeaseFire was responsible for sharp dips in homicide around the city. Slutkin, some say, gives CeaseFire too much credit. Carl Bell, the psychiatrist, was on the program with Slutkin that night. "I didn't say anything," he told me. "I support Slutkin. I'm like, Slutkin, what are you doing? You can't do that. Maybe politically it's a good thing, but scientifically it's so much more complex than that. Come on, Gary."

Last year, CeaseFire lost its \$6 million in annual state financing — which meant a reduction from 45 interrupters to 17 — as part of statewide budget cuts. One state senator, who had ordered an audit of CeaseFire (released after the cuts, it found some administrative inefficiencies), maintained there was no evidence that CeaseFire's work had made a difference. (The cuts caused considerable uproar: The Chicago Tribune ran an editorial urging the restoration of financing, and the State House overwhelmingly voted to double CeaseFire's financing; the State Senate, though, has yet to address it.)

It can be hard to measure the success — or the failure — of public-health programs, especially violence-prevention efforts. And given Slutkin's propensity to cite scientific studies, it is surprising that he hasn't yet published anything about CeaseFire in a peer-reviewed journal. Nonetheless, in a report due out later this month, independent researchers hired by the Justice Department (from which CeaseFire gets some money) conclude that CeaseFire has had an impact. Shootings have declined around the city in recent years. But the study found that in six of the seven neighborhoods examined, CeaseFire's efforts reduced the number of shootings or attempted shootings by 16 percent to 27 percent more than it had declined in comparable neighborhoods. The report also noted — with approbation — that CeaseFire, unlike most programs, manages by outcomes, which means that it doesn't measure its success by gauging the amount of activity (like the number of interrupters on the street or the number of interruptions — 1,200 over four years) but rather by whether shootings are going up or down. One wall in Slutkin's office is taken up by maps and charts his staff has generated on the location and changes in the frequency of shootings throughout the city; the data determine how they assign the interrupters. Wes Skogan, a professor of political science at Northwestern (disclosure: I teach there) and the author of the report, said, "I found the statistical results to be as strong as you could hope for."



BALTIMORE, NEWARK and Kansas City, Mo., have each replicated components of the CeaseFire model and have received training from the Chicago staff. In Baltimore, the program, which is run by the city, combines the work of interrupters and outreach workers and has been concentrated in one East Baltimore neighborhood. (The program recently expanded to a second community.) Early research out of the Johns Hopkins Bloomberg School of Public Health shows that in the East Baltimore neighborhood there were on average two shootings a month just before the program started. During the first four months that interrupters worked the streets, there had not been a single incident.

“My eyes rolled immediately when I heard what the model was,” says Webster of Johns Hopkins, who is studying the Baltimore project. Webster knew the forces the interrupters were up against and considered it wishful thinking that they could effectively mediate disputes. “But when I looked closer at the data,” Webster continues, “and got to know more about who these people were and what they were doing, I became far less skeptical and more hopeful. We’re going to learn from it. And it will evolve.” George Kelling, a Rutgers professor of criminal justice who is helping to establish an effort in Newark to reduce homicide, helped develop the “broken window” theory of fighting crime: addressing small issues quickly. He says a public-health model will be fully effective only if coupled with other efforts, including more creative policing and efforts to get gang members back to school or to work. But he sees promise in the CeaseFire model. “I had to overcome resistance,” Kelling told me, referring to the introduction of a similar program in Newark. “But I think Slutkin’s on to something.”

Most of the police officials I spoke with, in both Chicago and Baltimore, were grateful for the interrupters. James B. Jackson, now the first deputy superintendent in Chicago, was once the commander of the 11th district, which has one of the highest rates of violent crime in the city. Jackson told me that after his officers investigated an incident, he would ask the police to pull back so the interrupters could mediate. He understood that if the interrupters were associated with the police, it would jeopardize their standing among gang members. “If you look at how segments of the population view the police department, it makes some of our efforts problematic,” Baltimore’s police commissioner, Frederick H. Bealefeld III, told me. “It takes someone who knows these guys to go in and say, ‘Hey, lay off.’ We can’t do that.”

Like many new programs that taste some success, CeaseFire has ambitions that threaten to outgrow its capacity. Slutkin has put much of his effort on taking the project to other cities (there’s interest from Los Angeles, Oakland and Wilmington, Del., among others), and he has consulted with the State Department about assisting in Iraq and in Kenya. (CeaseFire training material has been made available to the provincial reconstruction teams in Iraq.) Meanwhile, their Chicago project is underfinanced, and the interrupters seem stressed from the amount of work they’ve taken on.

THE INTERRUPTERS have certain understandings. At the Wednesday meetings, no one is ever to mention anyone involved in a dispute by name or, for that matter, mention the name of the gang. Instead they refer to “Group A” or “Group B.” They are not investigators for the police. In fact, they go out of their way to avoid knowing too much about a crime. When Highsmith and Prater left me the night of the failed drug deal, they began working their contacts. Highsmith found someone who knew one of the stickup men and who, at Highsmith’s request, negotiated with them. Highsmith’s contact persuaded the robbers to return enough of the money to appease the drug-buyer’s anger. When I met with the intermediary a few weeks after things were resolved, he was still stirred up about the robbery. “I was mad enough to do anything,” he told me, making it clear that he and his friends had been hunting for the stickup guys. “This could’ve been a hell of a lot worse than it was.” To this day, neither Highsmith nor Prater know the identities of anyone except the intermediary — and they want to leave it that way.

The interrupters often operate by instinct. CeaseFire once received a call from the mother of a 15-year-old boy who wanted out of a gang he joined a few weeks earlier. The mother told Hoddenbach and another interrupter, Max Cerda, that the gang members chased her son home every day from school threatening to beat him. They had shot at him twice. Hoddenbach found the clique leaders and tried to talk sense to them. If the boy didn’t want to be in the gang, he told them, he’d be the first one to snitch. The gang members saw the logic behind that but insisted on giving him a beating before releasing him. Hoddenbach then tried another tack: he negotiated to let him leave the gang for \$300 — and no thrashing. The family,



though, was only able to come up with \$50, so Hoddenbach, Cerda and another interrupter came up with the rest. At their next Wednesday meeting, some interrupters were critical of Hoddenbach for paying what they considered extortion money. “It was kind of a messed-up way, but it was a messed-up way that works,” Hoddenbach said.

It was nearly three months before Charles Mack could find time to visit Frederick, the young shooting victim. Frederick had since moved in with his great-grandmother in a different part of town. In his old neighborhood, he told Mack, “there always somebody who knows you. And I had a reputation.” He complained to Mack that he had never been interviewed by the police but then declared he would never identify the person who shot him anyway. “I’m going to leave it alone,” he said. As is so often the case, Frederick couldn’t remember the genesis of the disagreement between his clique and the other. Mack promised to stay in touch, and as we dropped him off, Mack turned to me and said, “I think he’s going to be all right.” It sounded like both a proclamation as well as hopeful aside.

Not long ago, I stopped by to visit with Hoddenbach at the Boys and Girls Club, where he holds down a second job. It was a Friday evening, and he was waiting for an old associate to come by to give him an introduction to a group of Hispanic kids on the far North Side. Apparently, earlier in the week, they bashed in the face of an African-American teenager with a brick. From what Hoddenbach could make out, it was the result of a long-simmering dispute — the equivalent of a dormant virus — and the victim’s uncle was now worried that it would set off more fighting. As we sat and talked, Hoddenbach seemed unusually agitated. His left foot twitched as if it had an electric current running through it. “If these idiots continue,” he told me, “somebody’s going to step up and make a statement.”

Hoddenbach also worried about Torres, who had recently gone back to Texas and found a job working construction. Hoddenbach says he originally hoped Torres would stay in Chicago and establish some roots, but then decided he’d be better off in another town. “I kept him out of one situation, but I can’t keep him out of all of them,” Hoddenbach said. This may well speak to CeaseFire’s limitations. Leaving town is not an option for most. And for those who have walked away from a shooting, like Torres, if there are no jobs, or lousy schools, or decrepit housing, what’s to keep them from drifting back into their former lives? It’s like cholera: you may cure everyone, you may contain the epidemic, but if you don’t clean up the water supply, people will soon get sick again.

Slutkin says that it makes sense to purify the water supply if — and only if — you acknowledge and treat the epidemic at hand. In other words, antipoverty measures will work only if you treat violence. It would seem intuitive that violence is a result of economic deprivation, but the relationship between the two is not static. People who have little expectation for the future live recklessly. On the other side of the coin, a community in which arguments are settled by gunshots is unlikely to experience economic growth and opportunity. In his book “The Bottom Billion,” Paul Collier argues that one of the characteristics of many developing countries that suffer from entrenched poverty is what he calls the conflict trap, the inability to escape a cycle of violence, usually in the guise of civil wars. Could the same be true in our inner cities, where the ubiquity of guns and gunplay pushes businesses and residents out and leaves behind those who can’t leave, the most impoverished?

In this, Slutkin sees a direct parallel to the early history of seemingly incurable infectious diseases. “Chinatown, San Francisco in the 1880s,” Slutkin says. “Three ghosts: malaria, smallpox and leprosy. No one wanted to go there. Everybody blamed the people. Dirty. Bad habits. Something about their race. Not only is everybody afraid to go there, but the people there themselves are afraid at all times because people are dying a lot and nobody really knows what to do about it. And people come up with all kinds of other ideas that are not scientifically grounded — like putting people away, closing the place down, pushing the people out of town. Sound familiar?”

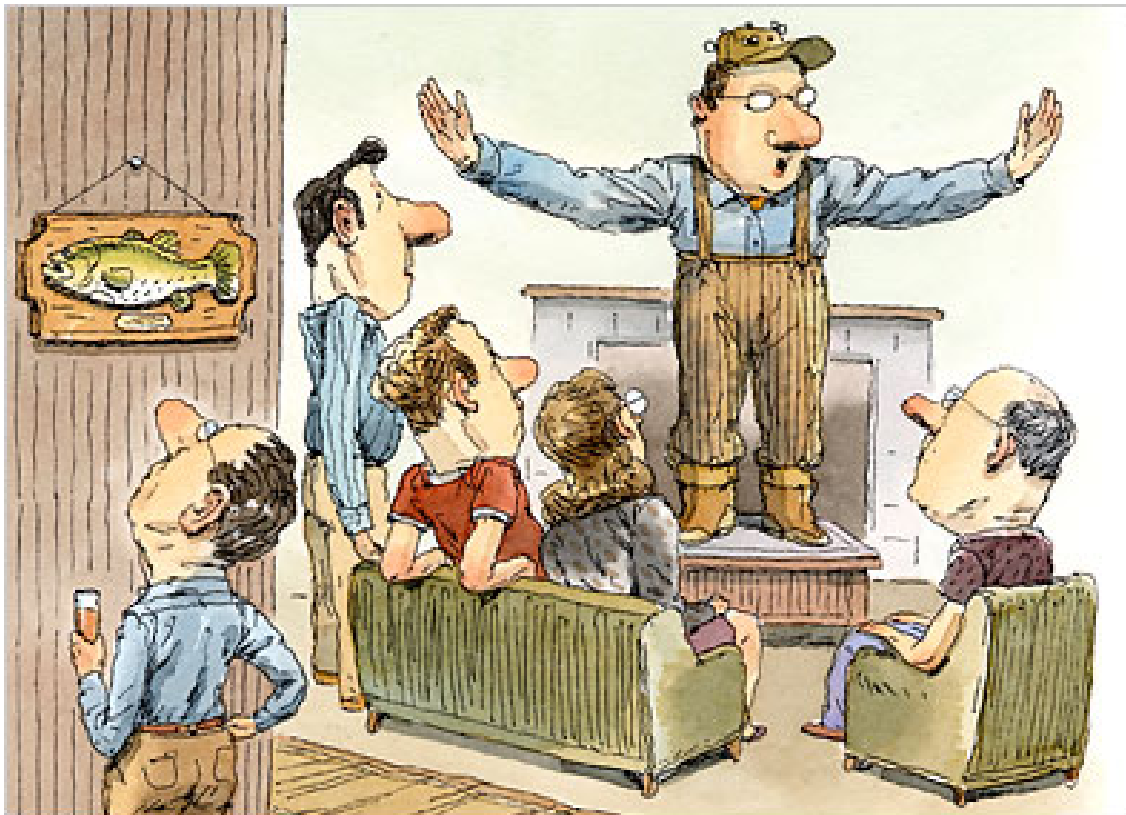
*Alex Kotlowitz teaches writing at Northwestern University and is a regular contributor to the magazine. His last article was about illegal immigration.*

<http://www.nytimes.com/2008/05/04/magazine/04health-t.html?th&emc=th>



## I'm Not Lying, I'm Telling a Future Truth. Really.

By BENEDICT CAREY



Some tales are so tall that they trip over their own improbable feats, narrative cracks and melodrama. That one-on-one playground victory over Kobe Bryant back in the day; the 34 hours in labor without painkillers; the former girlfriend or boyfriend who spoke eight languages and was a secret agent besides.

Yes, uh-huh, really. Is it closing time yet?

Yet in milder doses, self-serving exaggeration can be nearly impossible to detect, experts say, and there are several explanations.

A series of recent studies, focusing on students who inflate their grade-point average, suggests that such exaggeration is very different psychologically from other forms of truth twisting. Touching up scenes or past performances induces none of the anxiety that lying or keeping secrets does, these studies find; and embroiderers often work to live up to the enhanced self-images they project. The findings imply that some kinds of deception are aimed more at the deceiver than at the audience, and they may help in distinguishing braggarts and posers from those who are expressing personal aspirations, however clumsily.

“It’s important to emphasize that the motives driving academic exaggeration seem to be personal and ‘intrapyschic’ rather than public or interpersonal,” said Richard H. Gramzow, a psychologist at the University of Southampton in England who has led much of the research. “Basically, exaggeration here reflects positive goals for the future, and we have found that those goals tend to be realized.”

Psychologists have studied deception from all sides and have found that it usually puts a psychological or physical strain on the person doing the dissembling. People with guilty knowledge — of a detail from a





crime scene, for example — tend to show signs of stress, as measured by heart and skin sensors, under pointed questioning.

Trying to hold onto an inflammatory secret is mentally exhausting, studies have found, and the act of suppressing the information can cause thoughts of it to flood the consciousness. When telling outright lies, people tend to look and sound tenser than usual.

“Specifically, people are especially more tense when lying, compared to telling the truth, when they are highly motivated to get away with their lies and when they are lying about a transgression,” said Bella DePaulo, a visiting professor of psychology at the University of California, Santa Barbara.

But a study published in February in the journal *Emotion* found that exactly the opposite was true for students who exaggerated their grades. The researchers had 62 Northeastern University students fill out a computerized form asking, among other things, for cumulative grade point average. The students were then interviewed while hooked up to an array of sensitive electrodes measuring nervous system activation. The scripted interview covered academic history, goals and grades.

The researchers then pulled the students’ records, with permission, and found that almost half had exaggerated their average by as much as six-tenths of a point. Yet the electrode readings showed that oddly enough, the exaggerators became significantly more relaxed while discussing their grades.

“It was a robust effect, the sort of readings you see when people are engaged in a positive social encounter, or when they’re meditating,” said Wendy Berry Mendes, an associate professor of psychology at Harvard and senior author of the study. Dr. Gramzow and Greg Willard, then at Northeastern and now at Harvard, were co-authors.

The researchers videotaped the interviews, and independent observers rated how students looked and behaved. “The ones who exaggerated the most appeared the most calm and confident” on the ratings, Dr. Mendes said.

The grade inflation was less an attempt to deceive, the authors concluded, than a reflection of healthy overconfidence and a statement of aspirations. “It’s basically an exercise in projecting the self toward one’s goals,” Dr. Gramzow said.

In earlier studies, Dr. Gramzow and Dr. Willard found that students who bumped up their averages in interviews subsequently improved their grades — often by the very amount they had exaggerated.

The findings provide another lens through which to view claims, from Senator Hillary Rodham Clinton’s story of sniper fire in Bosnia to exaggerations of income, charitable contributions and SAT scores. As much as these are embroideries, they are also expressions of yearning, and for reachable goals.

In that sense, fibs can reflect something close to the opposite of the frustration, insecurity and secretiveness that often fuel big lies. That may be why they can come so easily, add up so fast and for some people — especially around closing time — become indistinguishable from the truth.

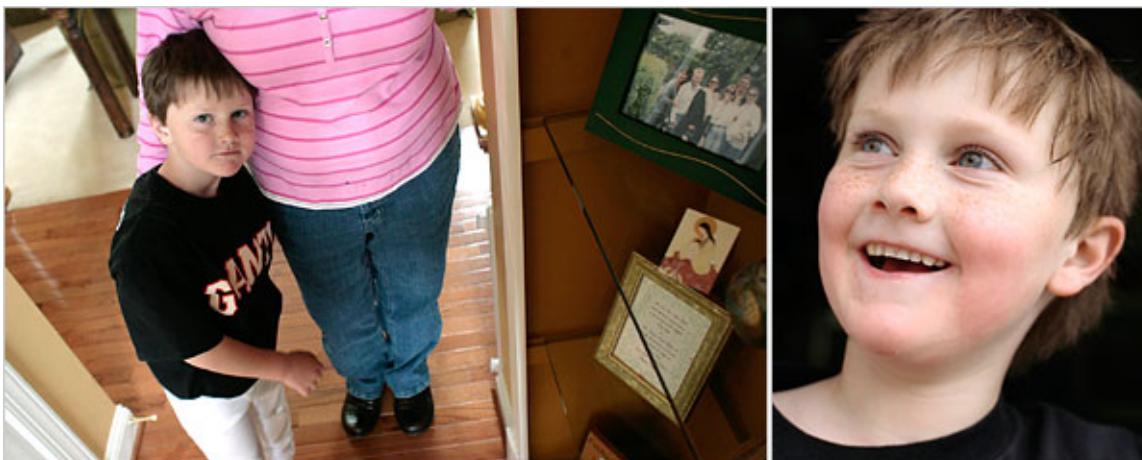
*The Well column will return May 20.*

[http://www.nytimes.com/2008/05/06/health/06mind.html?\\_r=1&nl=8hlth&emc=hltha1&oref=slogin](http://www.nytimes.com/2008/05/06/health/06mind.html?_r=1&nl=8hlth&emc=hltha1&oref=slogin)



## Redefining Disease, Genes and All

By ANDREW POLLACK



Duchenne muscular dystrophy may not seem to have much in common with heart attacks. One is a rare inherited disease that primarily strikes boys. The other is a common cause of death in both men and women. To Atul J. Butte, they are surprisingly similar.

Dr. Butte, an assistant professor of medicine at Stanford, is among a growing band of researchers trying to redefine how diseases are classified — by looking not at their symptoms or physiological measurements, but at their genetic underpinnings. It turns out that a similar set of genes is active in boys with Duchenne and adults who have heart attacks.

The research is already starting to change nosology, as the field of disease classification is known. Seemingly dissimilar diseases are being lumped together. What were thought to be single diseases are being split into separate ailments. Just as they once mapped the human genome, scientists are trying to map the “diseasome,” the collection of all diseases and the genes associated with them.

“We are now in a unique position in the history of medicine to define human disease precisely, uniquely and unequivocally,” three scientists wrote of the new approach last year in the journal *Molecular Systems Biology*. Such research aims to do more than just satisfy some basic intellectual urge to organize and categorize. It also promises to improve treatments and public health.

Scientists are finding that two tumors that arise in the same part of the body and look the same on a pathologist’s slide might be quite different in terms of what is occurring at the gene and protein level. Certain breast cancers are already being treated differently from others because of genetic markers like estrogen receptor and Her2, and also more complicated patterns of genetic activity.

“In the not too distant future, we will think about these diseases based on the molecular pathways that are aberrant, rather than the anatomical origin of the tumor,” said Dr. Todd Golub, director of the cancer program at the Broad Institute in Cambridge, Mass.

The reclassification may also help find drugs. “There are 40 drugs to treat heart attacks, but none to treat muscular dystrophy,” Dr. Butte said. If the diseases are similar in some molecular pathways, perhaps the heart attack drugs should be tested against muscular dystrophy.

Dr. Golub and colleagues at the Broad Institute have developed a “Connectivity Map,” which profiles drugs by the genes they activate as a way to find new uses for existing drugs.

The research will also improve understanding of the causes of disease and of the functions of particular genes. For instance, two genes have recently been found to influence the risk of both diabetes and prostate cancer.

“I’m shaking my head with disbelief that two genes would pop up in these two diseases that have absolutely nothing in common,” said Dr. Francis S. Collins, the director of the National Human Genome Research Institute. He said another gene, cyclin-dependent kinase inhibitor 2A, seemed to be involved in cancer, diabetes and heart disease.

A consistent way to classify diseases is also essential for tracking public health and detecting epidemics. The World Health Organization takes pains to periodically revise its International Classification of Diseases, which is used, among other ways, to tally the causes of death throughout the world. The classification is also the basis of the ICD-9 codes used for medical billing in the United States.



The first international classification, in the 1850s, had about 140 categories of disease, according to Dr. Christopher G. Chute, chairman of biomedical informatics at the Mayo Clinic. The 10th edition, in 1993, had 12,000 categories, said Dr. Chute, chairman of the committee developing the 11th version, due in 2015.

The increase stems mainly from better knowledge and diagnostic techniques that allow diseases to be distinguished from one another. For most of human history, diseases were named and classified by symptoms, which was all people could observe.

Linnaeus, the 18th-century Swedish scientist known for categorizing creatures into genus and species, also developed a taxonomy of disease. He had 11 classes — painful disease, motor diseases, blemishes and so on — that were further broken

down into orders and species. But not knowing about viruses, for instance, he classified rabies as a mental disease, Dr. Chute said.

In the 19th century, a big shift occurred. Doctors began learning how to peer inside the body. And diseases began to be classified by their anatomic or physiological features.

The stethoscope let doctors realize that what had been thought of as 17 conditions — like coughing up blood and shortness of breath — could all be different symptoms of the same disease, tuberculosis.

“The advent of the stethoscope made it possible to unify tuberculosis,” said Dr. Jacalyn Duffin, a professor of the history of medicine at Queen’s University in Ontario.

The shift from symptoms to anatomical measurements had big implications for patients, said Dr. Duffin, who is also a hematologist.

“Up until the 18th century, you had to feel sick to be sick,” she said. But now people can be considered sick based on measurements like high blood pressure without feeling ill at all.

Indeed, Dr. Duffin said, people who feel sick nowadays “don’t get to have a disease unless the doctor can find something” and instead might be told that it’s all in their head. Doctors argue, for instance, about



whether fibromyalgia or chronic fatigue syndrome, which have no obvious anatomical causes, are really diseases.

Genes might allow the study of diseases at a finer level than even physiological tests. Genes are the instructions for the production of proteins, which interact in complex ways to carry out functions in the body. Disruptions in these molecular pathways can cause disease.

“It gives you a direct connection to what the root causes are,” said Dr. David Altshuler, a professor of medicine and genetics at Harvard and Massachusetts General Hospital, and a researcher at the Broad Institute. “That is different from listening to a stethoscope.”

Some of the earliest work has until now been with inherited diseases caused by mutations in a single gene. Diseases have been subdivided by the type of mutation. Hemophilia was divided into hemophilia A and B, caused by mutations in different genes for different clotting factors. And what was once considered a mild form of hemophilia was later identified as a variant of a different clotting disorder, von Willebrand disease, caused by mutations in a different gene and requiring a different clotting factor as treatment.

Diseases are being lumped, as well as split. Researchers at Johns Hopkins reported in the April issue of *Nature Genetics* that two rare syndromes with different symptoms might represent a continuum of one disease. One syndrome, Meckel-Gruber, is tied to neural defects and death in babies. The other, Bardet-Biedl, is marked by vision loss, obesity, diabetes and extra fingers and toes.

The techniques are being applied to diseases for which the genetic cause is not as clearly known and which might be a result of multiple genes.

Dr. Butte uses data from gene chips that measure which genes are active, or expressed, in a cell. Amid thousands of studies using such chips, many compared the gene activity patterns in diseased tissue with that of healthy tissue.

Much of the raw data from such studies are deposited in a database. So Dr. Butte can gather data on gene activity for scores of diseases without leaving his desk. He then performs statistical analyses to map diseases based on similarities in their patterns of gene activity.

Other scientists use data on which genes appear to cause disease or contribute to the risk of contracting it.

Using such data, Marc Vidal, a biologist at Harvard, and Albert-Laszlo Barabasi, now a physicist at Northeastern University, created a map of what they called the “diseasome” that was published last year in *The Proceedings of the National Academy of Sciences*.

Diseases were represented by circles, or nodes, and linked to other diseases by lines that represent genes they have in common — something like the charts linking actors to one another (and ultimately to Kevin Bacon) based on the movies they appeared in together.

The number of genes associated with diseases is expanding rapidly because of so-called whole genome association studies. In these studies, gene chips are used to look for differences between the genomes of people with a disease and those without.

Multiple techniques can be combined. In a paper published online in *Nature* in March, scientists at Merck reconstructed the network of genes involved in obesity.

One area that might benefit from genetic disease classification is psychiatry. Because of the difficulty of measuring the brain, psychiatric diagnoses are still mainly based on symptoms. The Diagnostic and



Statistical Manual of Mental Disorders contains descriptions of conditions as diverse as acute stress disorder and voyeurism.

Scientists have found that certain genes appear to be associated with both schizophrenia and bipolar disorder. Those links, and the fact that some drugs work for both diseases, have prompted a debate over whether they are truly distinct disorders. “The way we categorize these into two separate entities is almost certainly not correct,” said Dr. Wade H. Berrettini, a professor of psychiatry at the University of Pennsylvania.

But Dr. Kenneth S. Kendler, a professor of psychiatry and human genetics at Virginia Commonwealth University, said that even if the two diseases shared genes, the diseases remained distinct. Schizophrenia is marked by hallucinations and impaired social functioning, and bipolar disorder by mood swings.

“It’s extremely naïve to think that psychiatric illnesses will collapse into categories defined by a gene,” he said. “Each gene at most has a quite modest effect on the illness.”

Some experts say that such limitations may hold true for other diseases, as well, and that genetics will not be able to unequivocally define and distinguish diseases. “We shouldn’t expect, nor will we get, this decisive clarity,” said Fiona A. Miller, associate professor of health policy, management and evaluation at the University of Toronto.

She and others said genetic classification could bring its own ambiguities. Newborns are now often screened for cystic fibrosis with the idea that they can be treated early to help avoid complications. But some infants with a mutation in the gene responsible for the disease are unlikely ever to have symptoms. Do they have the disease?

“We don’t know what to call these infants,” said Dr. Frank J. Accurso, a professor of pediatrics at the University of Colorado. “We don’t even have a good language for it yet.”

Still, Dr. Butte said nosology based on genes would one day make today’s classifications look as quaint as ones from 100 years ago look now. One category in the 1909 listing of the causes of death, for instance, was “visitation of God.”

“Imagine how they are going to be laughing at us,” he said. “Not 100 years from now, but even 50 or 20 years from now.”

<http://www.nytimes.com/2008/05/06/health/research/06dise.html?nl=8hlth&emc=hltha1>

## The Growing Wave of Teenage Self-Injury

By JANE E. BRODY

*“I feel relieved and less anxious after I cut. The emotional pain slowly slips away into the physical pain.”*

*“It’s a way to have control over my body because I can’t control anything else in my life.”*

*“It expresses emotional pain or feelings that I’m unable to put into words.”*

*“I usually feel like I have a black hole in the pit of my stomach. At least if I feel pain it’s better than nothing.”*



These are some of the reasons young people have given for why they deliberately and repeatedly injure their own bodies, a disturbing and hard-to-treat phenomenon that experts say is increasing among adolescents, college students and young adults.

Experts urge parents, teachers, friends and doctors to be more alert to signs of this behavior and not accept without question often spurious explanations for injuries, like “I cut myself on the countertop,” “I fell down the stairs” or “My cat scratched me.”

The sooner the behavior is detected and treated, the experts maintain, the more quickly it is likely to end without leaving lasting physical scars.

There are no exact numbers for this largely hidden problem, but anonymous surveys among college students suggest that 17 percent of them have self-injured, and experts estimate that self-injury is practiced by 15 percent of the general adolescent population.

Experts say self-injury is often an emotional response, not a suicidal one, though suicide among self-injurers is a concern.

The Canadian Mental Health Association describes it this way: “Usually they are not trying to end all feeling; they are trying to feel better. They feel pain on the outside, not the inside.”



Janis Whitlock, a psychologist who has interviewed about 40 people with histories of self-injury and is participating in an eight-college study of it, says the Internet is spreading the word about self-injury, prompting many to try it who might not otherwise have known about it.

“There is a rising trend for teens to discuss cutting on the Internet and form cutting clubs at school,” the Canadian association has stated.

Celebrities, too, have contributed to its higher profile. Among those who have confessed to being self-injurers are the late Princess Diana, Johnny Depp, Angelina Jolie, Nicole Richie, Richie Edwards, Courtney Love and the lead singer on the Garbage band album “Bleed Like Me.”

Common self-injuries include carving or cutting the skin, scratching, burning, ripping or pulling skin or hair, pinching, biting, swallowing sublethal doses of toxic substances, head banging, needle sticking and breaking bones. The usual targets are the arms, legs and torso, areas within easy reach and easily hidden by clothing.

Self-injury can become addictive. Experts theorize that it may be reinforced by the release in the brain of opioidlike endorphins that result in a natural high and emotional relief.

Dr. Whitlock, director of the Cornell Research Program on Self-Injurious Behavior in Adolescents and Young Adults, said in an interview that self-injury mainly seemed to function to “self-regulate feelings and help people cope with overwhelming negative emotions they have no other way to dispel.”

Self-injury makes some people feel part of a group. Teenagers who self-injure often report that there is no adult they could talk to who accepts them for who they are.

“A 13-year-old can go on the Internet and instantly find community and get hitched to this behavior,” Dr. Whitlock said. “When they don’t want to self-injure anymore, it means they have to leave a community.”

Self-injury can be manipulative, an effort to make others care or feel guilty or to drive them away. More often, though, it is secretive. Self-injurers may try to hide wounds under long pants and long sleeves even in hot weather, and may avoid activities like swimming.

### **Who Is Vulnerable?**

Self-injury often starts in the emotional turmoil of the preteen and early teenage years and may persist well into adulthood.

Although female self-injurers are more likely to be seen by a professional, in-depth studies indicate that the behavior is practiced equally by young men and women. No racial or socioeconomic group has been found to be more vulnerable, although self-injury is slightly less common among Asians and Asian-Americans, Dr. Whitlock said.

Interviews with self-injurers have found background factors that may prompt and perpetuate the behavior. A history of childhood sexual, and especially emotional, abuse has been reported by half or more of self-injurers. Some seek relief from the resulting emotional pain. Others self-inflict pain to punish themselves for what they perceive as their role in inviting the abuse.

Low self-esteem is common among self-injurers. Childhood neglect, social isolation and unstable living conditions have also been cited as risk factors. In about 25 percent of self-injurers, there is a history of eating disorders, as well as an overlap with risky drinking and unsafe sex.



The families of self-injurers commonly suppress unpleasant emotions. Children grow up not knowing how to express and deal with anger and sadness, instead turning emotional pain on themselves. Depression, for example, is often described as anger turned inward.

Although 60 percent of self-injurers have never had suicidal thoughts, self-injury can be a harbinger of suicidal behavior. It can also accidentally result in suicide.

“Those who self-injure should be evaluated for suicidal potential,” Dr. Whitlock said. There is some evidence that self-injury is more common among those with family histories of suicide. And some self-injurers suffer from chronic yet treatable emotional problems like depression, anxiety, post-traumatic stress disorder or obsessive-compulsive disorder.

Self-injury can be set off by certain events like being rejected by someone important, feeling wronged or being blamed for something over which the person had no control.

### **Treatment**

Although there are no specific medications to treat self-injury, drugs that treat underlying emotional problems like depression and anxiety can help. Most effective in general is a form of cognitive behavioral therapy called dialectical behavior therapy. People learn skills that help them better tolerate stress, regulate their emotions and improve their relationships.

The therapy also helps them see themselves not as victims, but as powerful agents, Dr. Whitlock said.

In addition, self-injurers can learn more wholesome ways to relieve stress like practicing meditation or yoga, engaging in vigorous physical activity or reaching out to a friend.

Some self-injurers have noted that they can sometimes avoid the behavior, Dr. Whitlock said, simply by doing something else for several minutes when the urge arises.

<http://www.nytimes.com/2008/05/06/health/06brod.html?nl=8h1th&emc=h1thb2>



## Some Diabetics Don't Have What They Thought They Had

By ANDREW POLLACK



Ryan Collins of Aldie, Va., was only 10 weeks old when doctors made the diagnosis: Type 1 diabetes. That meant up to eight insulin shots per day, a big burden on him and his family.

“He couldn’t be anywhere unless there was someone around to give a shot,” said his mother, Dana Collins. “Everything had to be planned. There was no impromptu anything.”

Until last month, that is, when Ryan, now almost 7, stopped needing shots.

Ryan, it turns out, does not have Type 1 diabetes after all. He has a rare form of diabetes, not yet discovered when he was born, that is caused by a genetic mutation. And it is treatable by a pill.

Ryan’s story is the latest case of how research is changing doctors’ understanding of diabetes.

Diabetes is named, from the Greek, for its symptoms of heavy thirst and frequent urination. But for hundreds of years, it has been possible to make a further breakdown. Diabetes mellitus, from the Latin for honeyed, was the form with sweet urine. Diabetes insipidus was marked by bland or insipid urine.

This may have been the first time two diseases with similar symptoms were distinguished by a “molecular” test. “We had receptors for one molecule and could figure it out,” said Dr. Yves A. Lussier, director of the center for biomedical informatics at the University of Chicago, referring to taste buds.

Today these are considered completely different diseases. Mellitus is the one commonly called diabetes. It involves high blood sugar and insulin. Insipidus is related to a different hormone, vasopressin.

In the 1930s, after it became possible to treat diabetes with insulin derived from animals, diabetes mellitus itself began to be subdivided into what would come to be called Type 1, marked by lack of insulin, and Type 2, marked by *insensitivity* to insulin. The distinction became stronger in the 1970s with the development of blood tests to tell them apart better, though there is still no definitive test.



Now, in just the last few years, scientists have found about 35 genes that influence the risk of getting diabetes, said Dr. David Altshuler, a professor of medicine and genetics at Harvard. But so far, there is no overlap at all between the genes that help cause Type 1 and those that help cause Type 2, he said.

“In that regard, it’s held up that they are separate diseases at the genetic level,” Dr. Altshuler said.

Some scientists think genetic analysis will further subdivide Type 2. While there is yet no major new class (a Type 3 or Type 4), scientists are discovering the genetic causes of several rare types of diabetes that are caused by single mutations.

The most common such “monogenic” diabetes is maturity-onset diabetes of the young, or MODY. Dr. Andrew Hattersley of the University of Exeter in England, a leading researcher, said 1 percent to 2 percent of diabetics might have MODY. But most do not know it. “There were a whole lot of people misdiagnosed as Type 1 or Type 2,” Dr. Hattersley said. But now there are genetic tests for MODY, and people with MODY might need less treatment, he said.

Dr. Hattersley has also helped show that diabetes diagnosed in the first six months of life is monogenic. And about half those cases are caused by a particular mutation that can be overcome by sulfonylurea pills, an old and inexpensive class of diabetes drugs.

After he tested positive for that mutation, Ryan Collins spent five days last month in the University of Chicago Medical Center, where doctors gradually substituted the pills for the insulin.

Thirty-five or so American children with that mutation have now been weaned off insulin, according to the Chicago medical center, which has been involved in many of the cases. It says there may be 1,000 to 2,000 such children who have not been identified.

Ryan now takes three small pills with breakfast and three with dinner. His body is making insulin again, and his blood sugar is better controlled than when he was taking all those shots.

“He’s ecstatic,” Ms. Collins said. “For this summer, I’m signing him up for summer camp, which he’s never been able to do before.”

<http://www.nytimes.com/2008/05/06/health/research/06hist.html?nl=8hlth&emc=hltha2>



## Forcing Sobriety, However Imperfectly

By HOWARD MARKEL, M.D.



Like most patients assigned to my substance abuse clinic these days, John, a stylish 22-year-old cosmetology student, did not arrive voluntarily.

After two drunken driving violations, one in which another motorist was injured, a judge ordered John to attend a weekly recovery group I conduct for young adults facing similar legal troubles. But that was hardly the biggest stick the judge had at his disposal.

“This Scram keeps me from even thinking about drinking,” John immediately told me as he raised a pant leg and pointed to a boxy plastic ankle bracelet that looked neither cool nor comfortable.

Scram, for Secure Continuous Remote Alcohol Monitor, records the wearer’s alcohol intake by measuring air and perspiration emissions from the skin every hour. It detects blood alcohol levels as low as 0.02 percent, which corresponds to one drink or less an hour, and can even tell when the alcohol was consumed.

Once a day, John has to be near a modem so it can transmit data from the last 24 hours to a monitoring agency and his probation officer.

Last year, American courts ordered Scram devices on thousands of defendants released on bond and awaiting trial for alcohol-related offenses, those sentenced to probation, and under-age drinkers. They pay a monitoring agency an average of \$12 a day for the device, as well as installation and service fees.

Criminal justice professionals report high compliance rates, at least while these people remain in the court system. Last summer, the actress Lindsay Lohan wore one.

Yet the device is not perfect.

For one thing, it can lead to unexpected and embarrassing situations. When John was chosen by a favorite instructor to work on a fashion show at the airport, he worried how to inform her before his device was discovered by airport security. I urged him to be honest, and fortunately the teacher proved entirely supportive. She suggested letting the others in their group pass through security first and, a little later, explaining the situation to the inspectors. “It worked like a charm,” John told me the next week.



Defense lawyers say that despite widespread use, independent, peer-reviewed scientific data is lacking on the device's reliability and the technology it uses to measure alcohol levels.

False positive readings are also a risk. Among other things, baked goods like raisin bread and sourdough English muffins can cause the body to produce its own alcohol. And like any computer-based device, the Scram can malfunction.

On the Web, bloggers recommend "scamming the Scram" by placing lunch meat, tape or paper between the ankle and the sensor or plunging the leg into an ice-cold bath to prevent perspiration.

Alcohol Monitoring Systems Inc., which manufactures the device, says such ploys do not work because they block the sensors, setting off a tamper alarm that is transmitted online to the monitoring agency and then to the court system.

John can testify that the notification is swift. One afternoon, he received a call from his probation officer about a tamper alarm recorded from 5 to 6 o'clock that morning. John convinced the officer that he was neither drinking nor scamming and provided evidence of reporting to work sober at 8 a.m.

Because his device had never registered alcohol consumption in all the time he had worn it, the officer gave him a second chance. The next morning, the same thing happened.

A stressful conference followed. "I've got to admit," John recalled, "it was looking pretty bad." Fortunately, the probation officer was in an experimental mood.

The culprit was a five-month buildup of sweat and dirt on the sensors. There have been no false alarms since the device was thoroughly cleaned.

John is beginning to understand the severity of his alcohol addiction and how it threatens his life and well-being. Over the past five months, I believe, he has remained sober and made significant progress.

But I have also treated enough substance abusers to be suitably impressed by the consuming grip of the disease. Active alcoholics do not often tell me the truth about their abuse. They lie, in essence, to protect the continued use of their most cherished commodity.

One could argue that Scram and the threat of jail bought those five months of sobriety and treatment for John.

As a physician, I remain uncomfortable aiding and abetting coercive methods like Scram.

But this concern is overshadowed by a far greater one surrounding his long-term health. Soon John will "graduate" from his court-supervised treatment. His real test of recovery begins the day his Scram device is removed from his ankle.

*Howard Markel is a professor of pediatrics, psychiatry and the history of medicine at the University of Michigan.*

<http://www.nytimes.com/2008/05/06/health/views/06essa.html?nl=8hlth&emc=hltha8>

## The Claim: Running Outdoors Burns More Calories

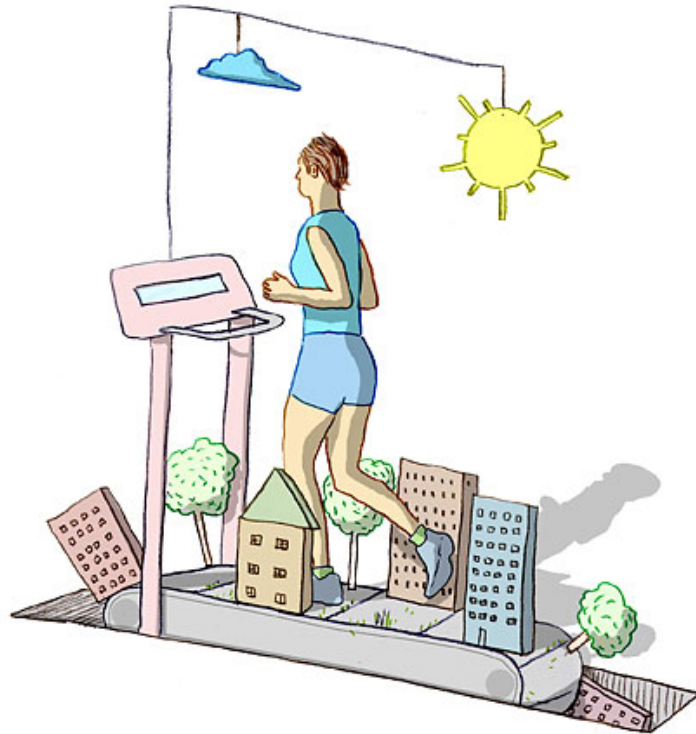
By ANAHAD O'CONNOR

### THE FACTS

Pavement or treadmill? Most avid runners have a strong preference for one or the other, but how do the two differ in producing results?

According to several studies, the answer is not so simple. Researchers have found in general that while outdoor running tends to promote a more intense exercise, running on a treadmill helps reduce the likelihood of injury, and thus may allow some people to run longer and farther.

A number of studies have shown that in general, outdoor running burns about 5 percent more calories than treadmills do, in part because there is greater wind resistance and no assistance from the treadmill belt. Some studies show, for example, that when adults are allowed to set their own paces on treadmills and on tracks, they move more slowly and with shorter strides when they train on treadmills.



But other studies show that treadmill exercisers suffer fewer stress injuries in the leg. One study published in 2003 in the British journal of sports medicine, for example, analyzed a group of runners and found significantly higher rates of bone strain and tension during pavement running than during treadmill running, particularly in the tibia, or shinbone. This increased strain can heighten the risk of stress fractures by more than 50 percent, the study found.

### THE BOTTOM LINE

Studies suggest that running on pavement generally burns slightly more calories, but also raises the risk of stress fractures. ANAHAD O'CONNOR

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<http://www.nytimes.com/2008/05/06/health/06real.html?nl=8hlth&emc=hlthb2>

## Trouble In Paradise: Global Warming A Greater Danger To Tropical Species



*This leaf beetle, which lives in the cloud forest on the east slope of the Andes Mountains in Ecuador, is from the family Chrysomelidae. Climate change could have a much bigger impact on such tropical species than scientists previously thought. (Credit: Kimberly Sheldon, University of Washington)*

ScienceDaily (May 6, 2008) — Polar bears fighting for survival in the face of a rapid decline of polar ice have made the Arctic a poster child for the negative effects of climate change. But new research shows that species living in the tropics likely face the greatest peril in a warmer world.

A team led by University of Washington scientists has found that while temperature changes will be much more extreme at high latitudes, tropical species have a far greater risk of extinction with warming of just a degree or two. That is because they are used to living within a much smaller temperature range to begin with, and once temperatures get beyond that range many species might not be able to cope.

"There's a strong relationship between your physiology and the climate you live in," said Joshua Tewksbury, a UW assistant professor of biology. "In the tropics many species appear to be living at or near their thermal optimum, a temperature that lets them thrive. But once temperature gets above the thermal optimum, fitness levels most likely decline quickly and there may not be much they can do about it."

Arctic species, by contrast, might experience temperatures ranging from subzero to a comparatively balmy 60 degrees Fahrenheit. They typically live at temperatures well below their thermal limit, and most will continue to do so even with climate change.

"Many tropical species can only tolerate a narrow range of temperatures because the climate they experience is pretty constant throughout the year," said Curtis Deutsch, UCLA assistant professor of atmospheric and oceanic sciences and co-author of the study.

### Why should we be concerned with the fate of insects in the tropics?

"The biodiversity of the planet is concentrated in tropical climates, where there is a tremendous variety of species," Deutsch said. "This makes our finding that the impacts of global warming are going to be most



detrimental to species in tropical climates all the more disturbing. In addition, what hurts the insects hurts the ecosystem. Insects carry out essential functions for humans and ecosystems -- such as pollinating our crops and breaking down organic matter back into its nutrients so other organisms can use them. Insects are essential to the ecosystem."

At least for the short term, the impact of global warming will have opposing effects. In the tropics, warming will reduce insects' ability to reproduce; in the high latitudes, the ability of organisms to reproduce will increase slightly, Deutsch said. If warming continues, the insects in the high latitudes would eventually be adversely affected as well.

"Unfortunately, the tropics also hold the large majority of species on the planet," he said.

Tewksbury and Deutsch are lead authors of a paper detailing the research, published in the May 6 print edition of the Proceedings of the National Academy of Sciences. The work took place while Deutsch was a UW postdoctoral researcher in oceanography.

The scientists used daily and monthly global temperature records from 1950 through 2000, and added climate model projections from the Intergovernmental Panel on Climate Change for warming in the first years of the 21st century. They compared that information with data describing the relationship between temperatures and fitness for a variety of temperate and tropical insect species, as well as frogs, lizards and turtles. Fitness levels were measured by examining population growth rates in combination with physical performance.

"The direct effects of climate change on the organisms we studied appear to depend a lot more on the organisms' flexibility than on the amount of warming predicted for where they live," Tewksbury said. "The tropical species in our data were mostly thermal specialists, meaning that their current climate is nearly ideal and any temperature increases will spell trouble for them."

As temperatures fluctuate, organisms do what they can to adapt. Polar bears, for example, develop thick coats to protect them during harsh winters. Tropical species might protect themselves by staying out of direct sunlight in the heat of the day, or by burrowing into the soil.

However, since they already live so close to their critical high temperature, just a slight increase in air temperature can make staying out of the sun a futile exercise, and the warming might come too fast for creatures to adapt their physiologies to it, Tewksbury said.

Other authors of the paper are Raymond Huey, Kimberly Sheldon, David Haak and Paul Martin of the University of Washington and Cameron Ghalambor of Colorado State University. The research was funded in part by the National Science Foundation and the UW Program on Climate Change.

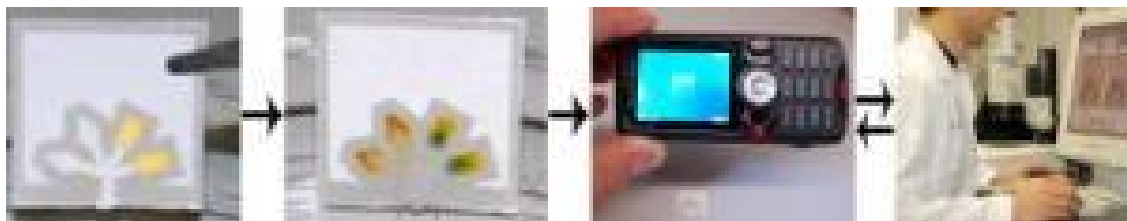
The work has indirect implications for agriculture in the tropics, where the bulk of the world's human population lives. The scientists plan further research to examine the effects of climate change, particularly hotter temperatures, on tropical crops and the people who depend on them.

"Our research focused only on the impact of changes in temperature, but warming also will alter rainfall patterns," Deutsch said. "These effects could be more important for many tropical organisms, such as plants, but they are harder to predict because hydrological cycle changes are not as well understood."

*Adapted from materials provided by [University of Washington](http://www.science.gov).*

<http://www.sciencedaily.com:80/releases/2008/05/080505211835.htm>

### Talking Up A New Role For Cell Phones In Telemedicine



*In the first image, the entrance to the microfluidic device (bottom center of strip) is dipped into urine. Next, the urine wicks into the assay zones. In the third photo, a cell phone camera digitizes the results and transmits them to an expert. Finally, an expert interprets the results and replies with a treatment. (Credit: Courtesy of George M. Whitesides, Harvard University)*

ScienceDaily (May 6, 2008) — After launching a communications revolution, cell phones are talking up a potentially life-saving new role in telemedicine -- the use of telecommunications technology to provide medical diagnosis and patient care when doctors and patients are hundreds or thousands of miles apart. Researchers in the United States and Brazil describe development of a simple, inexpensive telemedicine system that uses ordinary cell phone cameras to collect medical data from patients and transmit the data to experts located offsite for analysis and diagnosis.

The system is ideal for developing countries or remote areas lacking advanced medical equipment and trained medical specialists, the researchers say. The system can also transmit urgent medical data from battlefields, disaster zones, and other dangerous locations, they say. The study is scheduled for publication in the May 15 issue of the American Chemical Society's *Analytical Chemistry*, a semi-monthly journal.

The key to a successful medical treatment is a quick, accurate diagnosis of disease. But some areas, particularly in developing countries, lack access to advanced medical equipment and trained medical personnel that are required for a speedy diagnosis. A better, more practical system for conducting medical analysis in these remote areas is needed.

Enter cell phones: The popular, inexpensive devices are owned by almost 3 billion users worldwide, or roughly half the world's population. Millions of new cell phone users are added each year in countries such as Africa, India, China, and South America. When equipped with cameras, the ubiquitous devices can conceivably be used in remote areas as the eyes and ears of doctors without the need for an on-site visit.

"The cellular communications industry is, and will continue to become, a global resource that can be leveraged for detecting disease," says study leader George M. Whitesides, Ph.D., a professor of chemistry at Harvard University in Cambridge, Mass. Two recent studies by other researchers showed that cell phones can be used to acquire and transmit images of wounds and rashes to off-site locations for diagnosis, he notes.

In the new study, Whitesides collaborated with researchers in Brazil to design a prototype system that combines cell phone cameras with easy-to-use, paper-based diagnostic tests that undergo color changes when exposed to certain disease markers. The researchers demonstrated the feasibility of the system by using paper test-strips to collect and characterize artificial urine samples, as urine can be easily obtained from patients and contains a wide range of disease markers.

Using a simple cell phone camera, the scientists took pictures of the color-changing test-strips and transmitted them remotely to an off-site expert. The trained expert accurately measured glucose and protein levels -- used as hallmarks to diagnose various kidney diseases -- from the test-strip image. Similar tests can be conducted on other body fluids, including teardrops and saliva, the researchers say.





Besides diagnosing diseases in humans, the system can also be used to detect disease in plants and livestock and for testing the quality of water and food, the researchers say. The development of cheaper, mass-produced diagnostic tests will make the system more widely accessible in the future, notes Whitesides, who is known for his pioneering research toward making medical diagnostic tests more widely available for the developing world. He is also the recipient of the 2007 Priestley medal, ACS' highest honor.

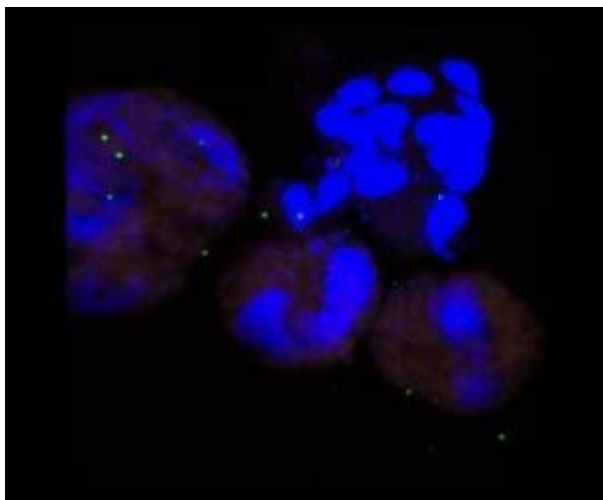
The study was supported by funding from the U.S. Department of Defense, the National Institutes of Health, Harvard University's Center for Nanoscale Science, the National Science Foundation, the Damon Runyon Cancer Research Foundation, the Foundation for Research Support of the State of São Paulo (Brazil), and the American Cancer Society.

*Adapted from materials provided by American Chemical Society, via EurekAlert!, a service of AAAS.*

<http://www.sciencedaily.com:80/releases/2008/05/080505120705.htm>



## Red Tide Killer Identified: Bacteria Gang Up On Algae, Quashing Red Tide Blooms



Cells of the dinoflagellate *Lingulodinium polyedrum*, collected at sea during a bloom in the summer of 2005, shows reddish areas signifying natural chlorophyll fluorescence, blue areas revealing DNA and green "dots" marking the cells of RCA cluster, bacteria implicated as a red tide killer. (Credit: Scripps Institution of Oceanography, UC San Diego)

ScienceDaily (May 6, 2008) — Researchers at Scripps Institution of Oceanography at UC San Diego have identified a potential "red tide killer." Red tides and related phenomena in which microscopic algae accumulate rapidly in dense concentrations have been on the rise in recent years, causing hundreds of millions of dollars in worldwide losses to fisheries and beach tourism activities. Despite their wide-ranging impacts, such phenomena, more broadly referred to as "harmful algal blooms," remain unpredictable in not only where they appear, but how long they persist.

New research at Scripps has identified a little-understood but common marine microbe as a red tide killer, and implicates the microbe in the termination of a red tide in Southern California waters in the summer of 2005.

While not all algal outbreaks are harmful, some blooms carry toxins that have been known to threaten marine ecosystems and even kill marine mammals, fish and birds.

Using a series of new approaches, Scripps Oceanography's Xavier Mayali investigated the inner workings of a bloom of dinoflagellates, single-celled plankton, known by the species name *Lingulodinium polyedrum*. The techniques revealed that so-called Roseobacter-Clade Affiliated ("RCA cluster") bacteria--several at a time--attacked individual dinoflagellate by attaching directly to the plankton's cells, slowing their swimming speed and eventually killing them.

Using DNA evidence, Mayali matched the identity of the RCA bacterium in records of algal blooms around the world.

In fact, it turns out that RCA bacteria are present in temperate and polar waters worldwide. Mayali's novel way of cultivating these organisms has now opened up a new world of inquiry to understand the ecological roles of these organisms. The first outcome of this achievement is the recognition of the bacterium's potential in killing red-tide organisms.

"It's possible that bacteria of this type play an important role in terminating algal blooms and regulating algal bloom dynamics in temperate marine waters all over the world," said Mayali.



The research study, which was coauthored by Scripps Professors Peter Franks and Farooq Azam, is published in the May 1 edition of the journal Applied and Environmental Microbiology.

"Our understanding of harmful algal blooms and red tides has been fairly primitive. For the most part we don't know how they start, for example," said Franks, a professor of biological oceanography in the Integrative Oceanography Division at Scripps. "From a practical point of view, if these RCA bacteria really do kill dinoflagellates and potentially other harmful algae that form dense blooms, down the road there may be a possibility of using them to mitigate their harmful effects."

The researchers based their results on experiments conducted with samples of a red tide collected off the Scripps Pier in 2005. Because RCA bacteria will not grow under traditional laboratory methods, Mayali developed his own techniques for identifying and tracking RCA through highly delicate "micromanipulation" processes involving washing and testing individual cells of *Lingulodinium*. He used molecular fluorescent tags to follow the bacteria's numbers, eventually matching its DNA signature and sealing its identity.

"The work in the laboratory showed that the bacterium has to attach directly to the dinoflagellate to kill it," said Mayali, "and we found similar dynamics in the natural bloom."

Franks said he found it a bizarre concept of scale that *Lingulodinium* dinoflagellates, which at 25 to 30 microns in diameter are known to swim through the ocean with long flagella, or appendages, are attacked by bacteria that are about one micron in size and can't swim.

"It's somewhat shocking to think of something like three chipmunks attaching themselves to an elephant and taking it down," said Franks.

While the RCA cluster's role in the marine ecosystem is not known, Azam, a distinguished professor of marine microbiology in the Marine Biology Research Division at Scripps, said harmful algal blooms are an important problem and consideration must be given to the fact that red tide dinoflagellates don't exist in isolation of other parts of the marine food web. Bacteria and other parts of the "microbial loop" feed on the organic matter released by the dinoflagellates and in turn the dinoflagellates are known to feed on other cells (including bacteria) when their nutrients run out.

Dinoflagellate interactions with highly abundant and genetically diverse bacteria in the sea have the potential to both enhance and suppress bloom intensity--but this important subject is only beginning to be explored.

"The newly identified role of RCA cluster is a good illustration of the need to understand the multifarious mechanisms by which microbes influence the functioning of the marine ecosystems," Azam said.

"This type of discovery is helping us understand algal bloom dynamics and the interactions among the components of planktonic ecosystems in ways that we'd imagined but previously lacked evidence," said Franks.

The National Oceanic and Atmospheric Administration's ECOHAB (Ecology of Harmful Algal Blooms) program funded the research.

*Adapted from materials provided by [University of California - San Diego](#), via [EurekAlert!](#), a service of AAAS.*

<http://www.sciencedaily.com:80/releases/2008/05/080501125429.htm>



## Nutrient Pollution Reductions From Urban Stream Restoration Quantified



*Researchers have been able to quantify the amount of nitrogen reduced through environmental restoration efforts in Minebank Run in Baltimore County, Md. (Credit: UMCES)*

ScienceDaily (May 6, 2008) — A team of researchers led by University of Maryland Center for Environmental Science researcher Dr. Sujay Kaushal has been among the first able to quantify the amount of excess nitrogen removed from an urban stream during environmental restoration projects. This breakthrough will allow environmental managers to accurately assess the pollution reducing benefits of stormwater management and urban stream restoration, and could lead to new nitrogen reduction opportunities as public works managers make repairs to our nation's aging urban infrastructure.

"The key to expanding urban stream restoration efforts nationwide is being able to quantify the environmental benefits gained from those efforts," said UMCES Chesapeake Biological Laboratory researcher Dr. Sujay Kaushal. "This research is opening the door to a new technology that has the potential to help improve water quality in our urban environment."

Using state-of-the-art techniques in a long-term study, Kaushal's team injected stable isotope tracers into restored and unrestored sections of an urban stream, and measured how microbes in the streambanks naturally absorb nitrate and convert it into inert nitrogen gas. By analyzing those samples, the team was able to determine in-the-field nitrogen reductions by stream microbes through a process known as denitrification.

The research showed that stream restoration techniques that "reconnected" the banks to the stream doubled nitrogen removal rates by microbes, and reduced nitrogen levels in ground water by 40%, contributing to significantly lower nitrogen levels in the stream compared to unrestored conditions. Getting water out of the stream channel into denitrification "hot spots" in floodplain wetlands helped improve water quality.

Nationwide, there is a growing need to reduce the amount of nutrients flowing into our coastal waters and restoration efforts are booming in areas adjacent to large urban population centers with acute nitrogen



pollution problems, such as near Chesapeake Bay, Long Island Sound, Puget Sound and the Gulf of Mexico.

"Miles of streams will likely need to be restored in upcoming years as our nation's failing infrastructure needs repair," Kaushal said. "Much like our study sites, most of this aging infrastructure was built before current stormwater practices were adopted. When repairing the aging bridge supports and sewer lines that share urban streambeds, public works managers can easily make restoration design changes to improve stormwater management and also increase the stream's ability to reduce nitrogen pollution flowing downstream."

"The science of restoration ecology is still in its infancy, and a great deal of knowledge is needed to achieve objectives," Kausal added. "Large-scale nitrogen reductions are needed along with improved stream restoration techniques that treat water flowing from polluted streams to coastal waters. The trick will be for scientists to figure out what works and what doesn't as we rebuild our cities for future generations."

The article, "Effects of Stream Restoration on Denitrification in an Urbanizing Watershed," appears in the April edition of *Ecological Applications*, a journal of the Ecological Society of America. This work was supported by the U.S. Environmental Protection Agency Office of Research and Development and the National Science Foundation's Long-Term Ecological Research program.

*Adapted from materials provided by University of Maryland Center for Environmental Science, via EurekAlert!, a service of AAAS.*

<http://www.sciencedaily.com:80/releases/2008/04/080430103945.htm>



## Birds Can Tell If You Are Watching Them -- Because They Are Watching You

*European starling. New research demonstrates that birds respond to a human's gaze. (Credit: iStockphoto/Andrew Howe)*

ScienceDaily (May 5, 2008) — In humans, the eyes are said to be the 'window to the soul', conveying much about a person's emotions and intentions. New research demonstrates for the first time that birds also respond to a human's gaze.



Predators tend to look at their prey when they attack, so direct eye-gaze can predict imminent danger. Julia Carter, a PhD student at the University of Bristol, and her colleagues, set up experiments that showed starlings will keep away from their food dish if a human is looking at it. However, if the person is just as close, but their eyes are turned away, the birds resumed feeding earlier and consumed more food overall.

Carter said "This is a great example of how animals can pick up on very subtle signals and use them to their own advantage".

Wild starlings are highly social and will quickly join others at a productive foraging patch. This leads to foraging situations that are highly competitive. An individual starling that assesses a relatively low predation risk, and responds by returning more quickly to a foraging patch (as in the study), will gain valuable feeding time before others join the patch.

Responses to obvious indicators of risk -- a predator looming overhead or the fleeing of other animals -- are well documented, but Carter argued that a predator's head orientation and eye-gaze direction are more subtle indicators of risk, and useful since many predators orient their head and eyes towards their prey as they attack.

This research describes the first explicit demonstration of a bird responding to a live predator's eye-gaze direction. Carter added: "By responding to these subtle eye-gaze cues, starlings would gain a competitive advantage over individuals that are not so observant. This work highlights the importance of considering even very subtle signals that might be used in an animal's decision-making process."

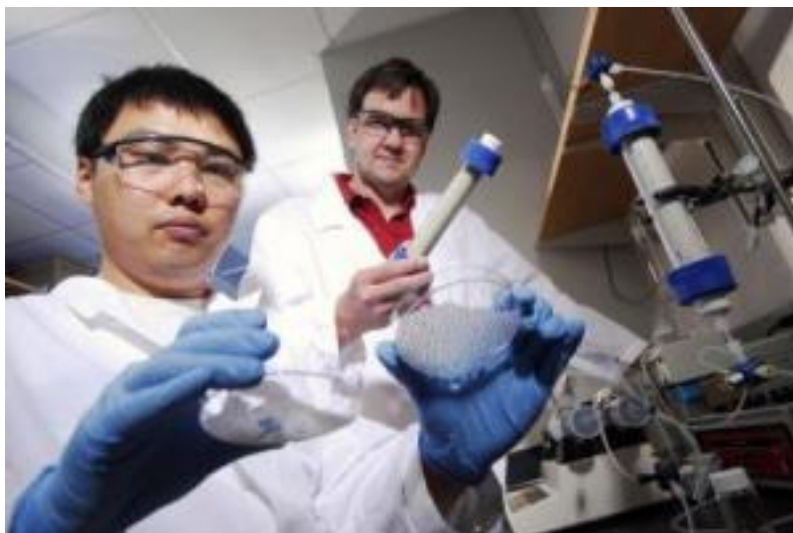
Do these birds understand that a human is looking at them, and that they might pose some risk? As yet, this question has not been answered. But whether or not the responses involve some sort of theory of mind, and whether or not they are innate or acquired, the result is that starlings are able to discriminate the very subtle eye-gaze cues of a nearby live predator and adjust their anti-predator responses in a beneficial manner.

These results are published online April 30 in Proceedings of the Royal Society B.

*Adapted from materials provided by [University of Bristol](#), via [EurekAlert!](#), a service of AAAS.*

<http://www.sciencedaily.com/releases/2008/04/080430075912.htm>

## Environmental Fate Of Nanoparticles Depends On Properties Of Water Carrying Them



Researchers Kurt Pennell (standing) and Younggang Wang examine glass microbeads and sand used to study the transport and retention of C<sub>60</sub> particles in water. (Credit: Georgia Tech Photo/Gary Meek)

ScienceDaily (May 5, 2008) — The fate of carbon-based nanoparticles spilled into groundwater -- and the ability of municipal filtration systems to remove the nanoparticles from drinking water -- depend on subtle differences in the solution properties of the water carrying the particles, a new study has found.

In slightly salty water, for example, clusters of Carbon 60 (C<sub>60</sub>) would tend to adhere tightly to soil or filtration system particles. But where natural organic compounds or chemical surfactants serve as stabilizers in water, the C<sub>60</sub> fullerene particles would tend to flow as easily as the water carrying them. "In some cases, the nanoparticles move very little and you would get complete retention in the soil," said Kurt Pennell, a professor in the School of Civil and Environmental Engineering at the Georgia Institute of Technology. "But in different solution conditions or in the presence of a stabilizing agent, they can travel just like water. The movement of these nanoparticles is very sensitive to the solution conditions."

Research into the transport and retention of C<sub>60</sub> nanoparticles was reported April 11 in the online version of the American Chemical Society journal *Environmental Science and Technology* and will be published later in the print edition. The research was funded by the U.S. Environmental Protection Agency.

Comparatively little research has been done on what happens to nanoparticles when they are released through accidental spills -- or when products containing them are discarded. Researchers want to know more about the environmental fate of nanoparticles to avoid creating problems like those of polychlorinated biphenyls (PCBs), in which the harmful effects of the compounds were discovered only after their use became widespread. "It will be difficult to control the waste stream, so these nanoparticles are likely to get everywhere," said Pennell. "We want to figure out now what will happen to them and how toxic they will be in the environment."

To study the flow and retention of the nanoparticles in simulated soil and filtration systems, Pennell's research team filled glass columns with either glass microbeads or sand, and saturated the columns with water. They then sent a "pulse" of water containing C<sub>60</sub> nanoparticles through the columns, followed by additional water containing no nanoparticles.

They measured the quantity of nanoparticles emerging from the columns and analyzed the sand and glass beads to observe the quantity of C<sub>60</sub> retained there. They also extracted the contents of the columns to measure the distribution of retained nanoparticles.



"In sand, we saw a uniform distribution of the nanoparticles throughout the column, which suggests that under the circumstances we examined, there is a limited retention capability due to filtration," Pennell explained. "Once that capacity is reached, the particles will pass through until they are retained by other grains of soil or sand."

Traditional theories regarding the activity of such packed-bed filters suggest that particles would build up near the column entrance, with concentrations falling off thereafter. The study findings suggest that the predictions of "filter theory" will have to be modified to explain the transport of nanoparticles in soil, Pennell said.

The nanoparticles retained were tightly bound to the sand or beads and could only be removed by changing the pH of the water.

"That would be a good thing if you were trying to filter these particles from a water system and were worried about them moving into the environment," Pennell said. "Once they go onto the soil system, it's unlikely that they will come off as long as the conditions don't change."

The researchers observed that up to 77 percent of the nanoparticle mass was retained by the sand, while the glass beads retained between 8 and 49 percent. Preparation of the solutions containing C<sub>60</sub> dramatically affected the retention; when no salt was added, the particles flowed through the columns like water.

"We want to make a mechanistic assessment of why the particles are attaching," Pennell said. "When we look at real soils with finer particles, we will expect to see more retention."

For municipal drinking water filtration, the sensitivity to solution characteristics means local conditions may play a key role.

"Under most conditions, you should be able to remove nanoparticles from the water," Pennell explained. "But you will have to be careful if the nanoparticles are stabilized by a natural surfactant or humic acid. If those are present in the water, the nanoparticles could go right through."

In a continuation of the work, Pennell and his Georgia Tech collaborators -- Joseph Hughes, John Fortner and Younggang Wang -- are now studying more complicated transport issues in real soils and with other types of nanoparticles. In field conditions, the nanoparticles are likely to be found with other types of carbon -- and potentially with other nanostructures.

"When we study systems with real soil, we will have background interference with humics and other materials," Pennell noted. "Ramping up the complexity will make this research a real challenge."

Ultimately, Pennell hopes to develop information about a broad range of nanoparticles to predict how they'll be retained and transported under a variety of conditions. Facilitating that is mathematical modeling being done by collaborators Linda Abriola and Yusong Li at Tufts University in Medford, Mass.

"We want to build up to the point that we can systematically vary properties and parameters," Pennell explained. "Over time, we should be able to classify nanoparticles based on their properties and have a good idea of how they will behave in the environment."

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<http://www.sciencedaily.com:80/releases/2008/05/080502091430.htm>

