



# Infoteca's E-Journal



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## Building a More Resilient Brain

- By SHIRLEY S. WANG

A lifetime of speaking two or more languages appears to pay off in old age, with recent research showing the symptoms of dementia can be delayed by an average of four years in bilingual people.

Multilingualism doesn't delay the onset of dementia—the brains of people who speak multiple languages still show physical signs of deterioration—but the process of speaking two or more languages appears to enable people to develop skills to better cope with the early symptoms of memory-robbing diseases, including Alzheimer's.



At Le Petit Paradis, preschoolers are learning their ABCs in both English and French. Aside from bilingualism's practical benefits, parents and experts alike say speaking multiple languages offer other advantages. WSJ's Christina Tsuei reports.

### Related Health Videos

Scientists for years studied children and found that fluently speaking more than one language takes a lot of mental work. Compared with people who speak only one language, bilingual children and young adults have slightly smaller vocabularies and are slower performing certain verbal tasks, such as naming lists of animals or fruits.

But over time, regularly speaking more than one language appears to strengthen skills that boost the brain's so-called cognitive reserve, a capacity to work even when stressed or damaged. This build-up of cognitive reserve appears to help bilingual people as they age.

"Speaking two languages isn't going to do anything to dodge the bullet" of getting Alzheimer's disease or dementia, says Ellen Bialystok, a bilingualism researcher at York University in Toronto. But greater cognitive reserve means the "same as the reserve tank in a car: Once the brain runs out of fuel, it can go a little farther," she says.

Specifically, the advantages of bilingualism are thought to be related to a brain function known as inhibitory or cognitive control: the ability to stop paying attention to one thing and focus on something else, says Dr. Bialystok. Fluent speakers of more than one language have to use this skill continually to silence one language in their minds while communicating in another.

The idea of building up cognitive reserve has led to the popular advice that doing crossword puzzles or brain teasers, anything to remain mentally active, helps stave off dementia symptoms. A panel convened by the National Institutes of Health in July cautioned, however, that there isn't enough evidence to conclude that such activities prevent Alzheimer's disease or related dementias.

Researchers don't know whether it is beneficial for people to learn more than one language if one doesn't speak them fluently or nearly every day. The age at which the second language needs to be acquired to yield the protective effect is also unknown.

Tamar Gollan, a researcher on bilingualism at the University of California San Diego and at the university's Alzheimer's Disease Research Center, says people can, of course, learn a new language if they want to, regardless of age. "But there's no magic point," Dr. Gollan cautions.

Dr. Bialystok began her decades-long research by studying how children learn a second language.

In 2004, she and her colleague Fergus Craik shifted to conduct three studies looking at the cognitive effects in some 150 monolingual and bilingual people between 30 and 80 years old. They found that in both middle and old age, the bilingual subjects were better able to block out distracting information than the single-language speakers in a series of computerized tests. The advantage was even more pronounced in the older subjects.

Dr. Bialystok says other research also shows better performance from bilingual people on tests requiring cognitive control, such as when they are instructed to determine whether a sentence is grammatically correct, even if the content doesn't make sense. For example, in distinguishing, "apples grow on trees" from "apple trees on grow" and "apples grow on noses," the third sentence requires people to focus on the structure and suppress paying attention to the meaning of the words.

The findings from the 2004 study led Dr. Bialystok to wonder whether these benefits might help older people compensate for age-related losses in learning.

She and her colleagues examined the medical records of 228 memory-clinic patients who had been diagnosed with different kinds of dementia, two-thirds with Alzheimer's disease. The results, published in the journal *Neuropsychologia* in 2007, suggested that bilingual patients exhibit problematic memory problems later than those who only spoke one language.

Bilingual patients were, on average, four years older than single-language speakers when their families first noticed memory problems, or when the patient first came to the clinic seeking treatment.

Moreover, bilingual patients' memories were no worse than those of single-language speakers by the time they arrived at the clinic, and there was no difference in the length of time between the detection of symptoms and when the patients were first checked in.

In a subsequent study, Dr. Bialystok and her colleagues looked at brain images of monolingual and bilingual Alzheimer's patients at the same age and stage of disease. They found that the brains of the bilingual people appeared to be in worse physical condition. This suggests that bilingualism doesn't delay the disease process itself, but rather helps bilingual individuals better handle memory deficits, Dr. Bialystok says.

Their group has confirmed the finding in a further study that will be published later this year, says Dr. Craik, a senior scientist at the Rotman Research Institute of Baycrest, which is affiliated with the University of Toronto.

Other research, however, complicates the picture of the potential benefits of multilingualism. A recent review of the medical records of some 600 people at a Montreal memory clinic showed a protective benefit for people who were fluent in more than two languages and for bilingual people who learned French before they learned English.

English-only speakers, however, fared just as well as multilingual people who learned English first. This anomaly might be explained by the English-speakers' particular genetics, nutrition, stress levels and environmental exposure, says Howard Chertkow, a cognitive neurologist at Jewish General Hospital in Montreal and a professor at McGill University, one of the authors on the study.

Researchers in Europe, such as Wouter Duyck, a professor at the University of Ghent in Belgium, are also working on similar studies to replicate the effect in other bilingual populations.

**Write to Shirley S. Wang at [shirley.wang@wsj.com](mailto:shirley.wang@wsj.com)**

<http://online.wsj.com/article/SB10001424052748703794104575545923443462444.html>

## Too Much TV Harms Kids Psychologically

### Parents may want to limit their children's computer use and TV viewing time to ensure their psychological well-being.

Many parents and children think that spending a lot of time on the computer or in front of the television is OK if it's part of a "balanced lifestyle."

Mon Oct 11, 2010 10:55 AM ET | content provided by AFP

Hiding the TV remote and games console controller is a good thing to do to kids if it's the only way to limit the time they spend in front of a screen, according to a study published Monday.

The study, conducted by researchers from the University of Bristol, found that youngsters who spend hours each day in front of the TV or games console have more psychological difficulties like problems relating to peers, emotional issues, hyperactivity or conduct challenges, than those who don't.

And contrary to what earlier studies have indicated, the negative impact of screen time was not remedied by increasing a child's physical activity levels, says the study, published in the journal *Pediatrics*.

The researchers got 1,013 children between the ages of 10 and 11 to self-report average daily hours spent watching television or playing -- not doing homework -- on a computer. Responses ranged from zero to around five hours per day.

The children also completed a 25-point questionnaire to assess their psychological state, and the time they spent in moderate to vigorous activity was measured using a device called an accelerometer, which was worn around the waist for seven days.

The researchers found that children who spent two hours or more a day watching television or playing on a computer were more likely to get high scores on the questionnaire, indicating they had more psychological difficulties than kids who did not spend a lot of time in front of a screen.

Even children who were physically active but spent more than two hours a day in front of a screen were at increased risk of psychological difficulties, indicating that screen time might be the chief culprit.

Earlier studies have found that while more time spent in front of a screen led to lower well-being, physical activity improved one's state of mind. That led researchers to believe that upping physical activity levels could counteract the negative impact of watching TV or playing on the computer.

And many parents and children think that spending a lot of time on the computer or in front of the television is OK if it's part of a "balanced lifestyle," the study in *Pediatrics* says.

"Excessive use of electronic media is not a concern if children are physically active," the study says.

But its findings indicate that might not be the case, and the researchers advise parents to limit their children's computer use and TV viewing time to ensure their "optimal well-being."

*Read more about the benefits of limiting screen time from the American Academy of Pediatrics.*



<http://news.discovery.com/human/children-television-psychological-effects.html#mkcpgn=rssnws1>

## An Unknown's Masterworks

By **WILLARD SPIEGELMAN**

*El Paso, Texas*

What happens if a tree falls in a forest and no one hears it? What happens if a man spends 30 years building an architectural- spiritual monument in the west Texas desert, which few people have seen and probably very few will ever see?



James Magee, whom the art scholar-critic Richard Brettell has called "America's greatest living unknown artist" (a claim logically impossible to verify), has lived and worked in El Paso, and on his country property more than an hour's drive to the east, since 1981. Like his work, his life has been, to say the least, unconventional.

Raised in small-town Michigan, equipped with a University of Pennsylvania law degree, Mr. Magee (born in 1946) spent a postlaw school year working for Caroline Lee, an American sculptor in Paris, and the next decade in New York. To support the making of art, he taught, drove a cab, served as consultant to the New York City Planning Office on Staten Island. He designed the sets for an Eastman School opera production. Then he landed in west Texas to work on oil rigs.

Rather, *they* landed here. Mr. Magee has several artistic alter egos, the most prominent of whom is a painter named Annabel Livermore. At the Magee house in downtown El Paso, you can see Livermore's paintings and watercolors, the former heavy in their impasto and symbolism, the latter light and decorative. Think of William Blake, an earlier eccentric and man of many arts. Livermore's pictures have been more widely exhibited and sold than Mr. Magee's sculptures. Laura Bush is a fan.

### **Revelation: The Art Of James Magee**

Nasher Sculpture Center

Through nov. 28

But the two-dimensional work of the artist's "female" half is less impressive than the three-dimensional sculptural and architectural pieces of Mr. Magee himself. Until recently, these works have been largely unknown in the art world—for several reasons.

First, Mr. Magee works slowly. His wall pieces number fewer than 100. Second, they are weighty. Anyone who buys one must essentially fortify a wall or construct an industrial space to put it on. Third, he says that gallery dealers who have visited his studio—a combination of junkyard, laboratory and scrap-metal shop—in downtown El Paso have left saying they didn't think they could find buyers for his work.

The Hill, Mr. Magee's masterwork (some might call it an obsession or a folly), has been under construction for three decades or more: The first piece he made that eventually went into The Hill was done in the early 1970s on Staten Island. He says he'll need another 15 years to complete the project. But he is in ill health. Will he finish? Does it matter if he doesn't? Even incomplete, it is impressive, indeed extraordinary.

But because The Hill is a work in progress, it is not open to the public. By comparison, getting to see such off-the-beaten-track treasures as Donald Judd's Chinati in Marfa, Texas, or Robert Smithson's Spiral Jetty in Utah, or Walter De Maria's Lightning Fields in New Mexico is easy. And Mr. Magee says he doesn't care what happens to the work when he dies.

What is The Hill? Many things: a combination of architecture and sculpture, of art and landscape. It consists of a quartet of 14-foot-high, flat-roofed buildings (one of which still lacks a finished interior), in a cruciform shape, sitting atop two intersecting elevated stone causeways. All is stone and metal. Light seeps through fiberglass panels from above. There is no electricity. Mr. Magee has done all the work, by hand, with the help of hired assistants who come and go. For the sake of the lucky visitor, they open and close the large metallic doors into the three edifices. Nondoctrinal religion, a pervading spirituality, defines the place and the experience of being there. Mr. Magee is the creator, the servant, the priest and—for the most part—the congregation.

The south, north and east buildings house a variety of sculpted shapes—vertical triptychs, altars, panels—all composed of industrial materials and filled with glass, cloth, metal, something that suggests an animal's flayed body, and various other detritus. The most spectacular installation is the horizontal floor sculpture in the east building. This vast piece is capped by a glass-and-metal cover that took four men 15 minutes to raise via a set of clanking pulleys. It looks like a lunar landscape designed by Corbusier and made of iron and steel objects, broken glass, ball bearings, beads, metal shavings, all arranged into shapes that remind us of things we know (a chair? a body? a road map? a destroyed city?) but have never seen before. It is a map of the imagination. When the chapel doors are open, you look through them and out to framed desert vistas, the same scenes you can see as an encompassing panorama once you step away from the buildings. The untended cacti, agave, yucca and delicate desert flowers seem as deliberate as anything at Versailles.

For anyone who cannot get the master to grant a visa to The Hill—that is, for virtually everyone—there are two other chances to sample his art. The Nasher Sculpture Center in Dallas has just mounted the first major museum exhibition of Mr. Magee's work in 18 years. It coincides with a splendid book, "James Magee: The Hill," with essays about (and pictures of) The Hill by Mr. Brettell and Jed Morse, the Nasher's chief curator, and also about the relief sculptures that hang on the walls at the museum.

These Nasher pieces alone make a trip to Texas worthwhile. Think of art that marries Joseph Cornell's delicately magical worlds-in-a-box with John Chamberlain's boldly colorful crushed automobile sculptures. Industrial materials and elements of chance have been part of modern art for more than a century, but Magee's wall pieces manage to combine and to transcend their influences.

They are powerful and delicate in equal measure. Framed by glass and steel, often evocatively titled and linked to poems by their maker (again Blake comes to mind), and often very large, they are gorgeous. If Annabel Livermore represents the anima of a double artist, and if the massive stone buildings at The Hill are the animus of Magee's Jungian persona, then these wall reliefs are the perfect blending of masculine and feminine, yin and yang, the industrial and the natural, the sublime and the beautiful, the found and the made. *Mr. Spiegelman, the Hughes professor of English at Southern Methodist University, writes about the arts for the Journal.*

<http://online.wsj.com/article/SB10001424052748703384204575509823111367854.html>

## The Myth of Separate Magisteria

Can — and should — science and religion avoid each other's turf?



photo: Ulf Andersen/Getty  
Stephen Jay Gould in Paris, May 1991  
By [Susan Jacoby](#)  
Thursday, October 7, 2010

By now, nearly everyone with a passing interest in science or religion is familiar with Stephen Jay Gould's description of the two disciplines as "non-overlapping magisteria" with separate domains — science in the physical universe and religion in the moral realm. [On this website](#), the philosopher Roger Scruton recently made the sweeping declaration that "genuine science and true religion cannot conflict." [A 2004 editorial in \*Nature\* magazine](#) insists that science and religion clash only when the two "stray onto each other's territories and stir up trouble."

One might as well say that conflict arises between men and women only when they stray onto each other's territories and stir up trouble. Science produces discoveries that challenge long-held beliefs (not only religious ones) based on revelation rather than evidence, and the religious must decide whether to battle or accommodate secular knowledge if it contradicts their teachings.

I know both scientists and religious believers for whom the idea of non-overlapping magisteria (NOMA) has become an unexamined fiction designed to skirt the culture wars. It is clear, however, that NOMA (a term Gould adapted from Catholic theology; the "Magisterium" is the Church's term for its teaching authority) is not only a fiction but a useless fiction — from the standpoint of both religion and science.

To cite one prominent example, scientists use embryonic stem cells in research aimed at developing treatments for currently incurable scourges of the body. Some church leaders, primarily Roman Catholics and conservative American Protestants, are doing everything they can to impede the research because their faith tells them that a six-day-old embryo is the equivalent of a person — and that destroying the cells for scientific purposes is murder.

The biomedical researcher who wants to continue working with embryonic stem cells is making a moral as well as a scientific judgment, and the cleric is making a judgment that constrains science. The domains have overlapped since science first began making discoveries that could promote, or, for that matter, threaten human welfare. When Dr. Edward Jenner developed an early form of vaccination against smallpox in 1796, many orthodox Christians — the most notable of whom was Yale's president, [the Rev. Timothy Dwight](#) —

considered vaccination an intrusion on God's plan, which supposedly required the ancient killer disease.

Why, then, do so many intellectuals now pay obeisance to the historically absurd idea of separate domains for science and religion? This is one critical question raised by Sam Harris (who, full disclosure, is a distant but good friend of mine) in his new book, *The Moral Landscape: How Science Can Determine Human Values*. The book is sure to provoke even more controversy than Harris's earlier works, because the author, a prominent voice among the New Atheists and the holder of a doctorate in neuroscience, rejects both religious notions of revealed truth and secular veneration of moral relativism.

He argues that "people who draw their worldview from religion generally believe that moral truth exists, but only because God has woven it into the very fabric of reality; while those who lack such faith tend to think that notions of 'good' and 'evil' must be the products of evolutionary pressure and cultural invention. My purpose is to persuade you that both sides in this debate are wrong...to begin a conversation about how moral truth can be understood in the context of science."

Harris, who notes that the original term for the physical sciences was "natural philosophy," believes that science has a crucial role to play in assessing moral values according to their observable earthly consequences. It seems perfectly obvious that while science can tell us nothing about a putative afterlife, it can tell us a great deal about whether specific beliefs produce or alleviate suffering in this life.

Numerous social science studies have shown, for example, that countries where women are forbidden to educate themselves, earn a living, or control their sexual lives are the poorest societies on earth by any objective measure of well-being — from health to poverty rates. How, then, can it be morally sound — regardless of whether people believe they are doing the will of God — to subjugate women?

In this instance, the cop-out for the separate magisteria establishment is that religions restricting the freedom of women must be "false." Those who uphold the notion of separate domains want domain over values for *their* religion — not *all* religion.

Neuroscience raises a red flag because it attempts to explain human behavior by studying the physical brain rather than by evoking the existence of a independent, non-physical soul. The idea that humans may not possess free will in the religious or secular senses — at least not to the degree we would like — is as threatening to our sense of human specialness today as Darwin's theory of evolution was in his time.

One reason why neuroscience inspires such unease is the influence that this relatively new discipline has already exerted on law. When the Supreme Court declared the death penalty for minors unconstitutional in 2005, the decision gave considerable weight to brain research (PDF) from the late 1980s and 1990s, when MRIs demonstrated that the brain's frontal cortex is significantly less developed in teenagers than in young adults. The frontal cortex controls "executive" functioning — which, among other cognitive tasks, includes the capacity to envisage the overall consequences of actions; i.e., judgment.

Those who oppose the use of scientific evidence to mitigate the legal responsibility of the young and the mentally ill sometimes point to the proverbial "slippery slope" in which scientific "excuses" will be used to exonerate criminals and to deny the very existence of good and evil.

The slippery slope is a powerful metaphor because it implies that eating the fruit of the tree of knowledge must lead inevitably to Cain's murder of his brother. But this image of a soul easily corrupted by knowledge, because it denies the possibility of human intervention to alter the curve, is actually more fatalistic than any neuroscientific findings.

I don't quite agree with Harris that science can "determine" values; I would have added the qualifier "help" to the title. But his insight that the emperors of separate magisteria have no clothes is critical if we are to talk about values in a way that returns the earthly welfare of human beings — as distinct from conflicting ideas held by humans about how to make it to heaven — to the center of the conversation.

**Susan Jacoby is the author of *Freethinkers: A History of American Secularism* and *The Age of American Unreason*.**

<http://www.bigquestionsonline.com/columns/susan-jacoby/the-myth-of-separate-magisteria>

## Bizarre X-Shaped Intruder Linked to an Unseen Asteroid Collision



*This series of images taken by Hubble's Wide Field Camera 3 clearly shows the slow evolution of the debris coming from asteroid P2010/A2, which is thought to be due to a collision with a smaller asteroid. When astronomers first spotted the unusual X shape, they assumed that they were observing the immediate aftermath of an impact. However, the slower than anticipated rate of change in the appearance of the debris suggests that the collision in fact took place about a year earlier than the first observations. These seven exposures were taken between January and May 2010 while the asteroid was rapidly receding from Earth. As the asteroid gets further away from us, we are able to see more of its comet-like tail in each subsequent frame. In the top picture, the portion of the tail we see is around 50,000 km long. In the bottom picture, we see around 85,000 km. For all images, the field of view remains about 75 arcseconds across. The images were taken in visible light (filter F606W) and artificially colored blue. (Credit: NASA, ESA and D. Jewitt (UCLA))*

ScienceDaily (Oct. 13, 2010) — Last January astronomers thought they had witnessed a fresh collision between two asteroids when images from the NASA/ESA Hubble Space Telescope revealed a bizarre X-shaped object at the head of a comet-like trail of material.

"When I saw the Hubble image I knew it was something special," says astronomer Jessica Agarwal, who works for the European Space Agency in the Netherlands. "The nucleus seemed almost detached from the dust cloud and there were intricate structures within the dust."

After using Hubble to track the oddball body for five months, astronomers were surprised to find that they had missed the suspected smash-up by a year.

"We thought that this event had just occurred," says astronomer David Jewitt of the University of California in Los Angeles and leader of the Hubble observations. "We expected the debris field to expand dramatically, like shrapnel flying from a hand grenade. So we rushed to apply for Hubble time to watch the aftermath. But what happened was quite the opposite. We found that the object is expanding very, very slowly and that it started not a week, but nearly a year before our January observations."

By his calculations, the encounter happened in February or March 2009. Jewitt is still excited about the Hubble observations because they are the first snapshots of the aftermath of a suspected asteroid collision.

Jewitt's results appear in the 14 October issue of the science journal *Nature*.

The peculiar object, dubbed P/2010 A2, was found in the asteroid belt, a reservoir of millions of rocky bodies between the orbits of Mars and Jupiter. Encounters between asteroids are assumed to be common, and destructive, but Jewitt estimates that modest-sized asteroids actually smash into each other roughly once a year. When the objects collide, they inject dust into interplanetary space. But until now, astronomers have relied on models to make predictions about the frequency of these collisions and the amount of dust they produce.

"These observations are important because we need to know where the dust in the Solar System comes from, and how much of it comes from colliding asteroids as opposed to 'outgassing' comets," Jewitt explains. "We can also apply this knowledge to the dusty debris discs around other stars, because these are thought to be produced by collisions between unseen bodies in the discs. Knowing how the dust was produced will yield clues about those invisible bodies."

The Hubble images, taken from January to May 2010 with Wide Field Camera 3, reveal a point-like object about 120 metres wide, with a long, flowing dust tail behind an X-shaped pattern of a kind that had never been seen before. The observations also show that the object retained its X-shape even as the debris field slowly expanded. Particle sizes in the tail are estimated to vary from about 1 millimetre to 2.5 centimetres in diameter.

The object in the Hubble image is the remnant of a slightly larger precursor body. Astronomers think a smaller rock, perhaps 3 to 5 metres wide, slammed into the larger one. The pair probably collided at high speed, at about 18 000 kilometres an hour, smashing and vaporising the small asteroid and stripping material from the larger one. Jewitt estimates that the violent encounter was as powerful as the detonation of a small atomic bomb.

Radiation pressure from the Sun then swept the debris behind the remnant asteroid, forming a comet-like tail. The tail contains enough dust to make a ball 20 metres wide, most of it blown out of the bigger body by the explosion that followed the impact.

The two asteroids were probably no strangers to collisions. They were themselves most likely relics from impacts between larger asteroids that occurred tens or hundreds of millions of years ago. The process that reduces asteroids from large to small bodies is known as collisional grinding and is thought to be one of the main processes by which asteroids are destroyed.

Astronomers do not have a good explanation for the X shape. The criss-crossed filaments at the head of the tail might suggest that the colliding asteroids were not perfectly symmetrical. Material would not then be ejected from the impact in a symmetrical pattern, just as a brick thrown into a lake makes a ragged splash. Larger particles in the X disperse very slowly and give this structure its longevity.

Although the Hubble images give compelling evidence for an asteroid collision, Jewitt says he still does not have enough information to rule out all alternative ideas. In one such scenario, a small asteroid's rotation increases from sunlight pressure and loses mass, forming the comet-like tail.

"Catching colliding asteroids on camera is difficult," Jewitt says, "because large impacts are rare, while small ones, such as the one that produced P/2010 A2, are exceedingly faint." The two asteroids whose remains make up P/2010 A2 were unknown before the smash-up because they were too faint to be noticed. The

collision itself was unobservable because it happened when the asteroids were in the same direction as the Sun. About 10 or 11 months later, in January 2010, the Lincoln Near-Earth Research (LINEAR) Program Sky Survey spotted the comet-like tail produced by the collision. But only Hubble resolved the X pattern, offering unequivocal evidence that something stranger than a comet outgassing had occurred.

Jewitt is confident that future telescopes will find plenty of asteroid encounters. He expects the planned Large Synoptic Survey Telescope (LSST) to spot dozens of asteroid collisions shortly after they happen. The LSST is a wide-field survey observatory that will scan the sky weekly for transitory events such as supernovae and for the presence of near-Earth asteroids.

Astronomers plan to use Hubble again in 2011 to view the remnant asteroid. Jewitt and his colleagues hope to see how far the dust has been swept back by the Sun's radiation and how the mysterious X-shaped structure has evolved.

The international team of astronomers in this study consists of David Jewitt (University of California, Los Angeles, USA), Harold Weaver (Johns Hopkins University, Baltimore, USA), Jessica Agarwal (ESTEC, European Space Agency, Noordwijk, Netherlands), Max Mutchler (Space Telescope Science Institute, Baltimore, USA), Michal Drahus (University of California, Los Angeles, USA)

### Links

*Nature* paper: [http://www.spacetelescope.org/static/archives/releases/science\\_papers/heic1016.pdf](http://www.spacetelescope.org/static/archives/releases/science_papers/heic1016.pdf) Previous press release from NASA on P/2010 A2: <http://hubblesite.org/newscenter/archive/releases/2010/07/>

### Contacts

Oli Usher Hubble/ESA Garching, Germany Tel: +49-89-3200-6855 Cell: +49-176-7648-2193 Email: [ousher@eso.org](mailto:ousher@eso.org)

Jessica Agarwal European Space Research and Technology Centre (ESTEC) Noordwijk, Netherlands Email: [je.agarwal@gmail.com](mailto:je.agarwal@gmail.com)

Donna Weaver Space Telescope Science Institute Baltimore, USA Tel: +1-410-338-4493 Email: [dweaver@stsci.edu](mailto:dweaver@stsci.edu)

David Jewitt University of California Los Angeles, USA Tel: +1-310-825-2521 Email: [jewitt@ucla.edu](mailto:jewitt@ucla.edu)

### Story Source:

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by [ESA/Hubble Information Centre](#).

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### Journal Reference:

1. David Jewitt, Harold Weaver, Jessica Agarwal, Max Mutchler, Michal Drahus. **A recent disruption of the main-belt asteroid P/2010?A2**. *Nature*, 2010; 467 (7317): 817 DOI: [10.1038/nature09456](https://doi.org/10.1038/nature09456)

<http://www.sciencedaily.com/releases/2010/10/101013131825.htm>

## Females Are Equal to Males in Math Skills, Large Study Shows



*Young women studying mathematics. The mathematical skills of boys and girls, as well as men and women, are substantially equal, according to a new examination of existing studies. (Credit: iStockphoto/Laurence Gough)*

ScienceDaily (Oct. 13, 2010) — The mathematical skills of boys and girls, as well as men and women, are substantially equal, according to a new examination of existing studies in the current online edition of journal *Psychological Bulletin*.

One portion of the new study looked systematically at 242 articles that assessed the math skills of 1,286,350 people, says chief author Janet Hyde, a professor of psychology and women's studies at the University of Wisconsin-Madison.

These studies, all published in English between 1990 and 2007, looked at people from grade school to college and beyond. A second portion of the new study examined the results of several large, long-term scientific studies, including the National Assessment of Educational Progress.

In both cases, Hyde says, the difference between the two sexes was so close as to be meaningless.

Sara Lindberg, now a postdoctoral fellow in women's health at the UW-Madison School of Medicine and Public Health, was the primary author of the meta-analysis in *Psychological Bulletin*.

The idea that both genders have equal math abilities is widely accepted among social scientists, Hyde adds, but word has been slow to reach teachers and parents, who can play a negative role by guiding girls away from math-heavy sciences and engineering. "One reason I am still spending time on this is because parents and teachers continue to hold stereotypes that boys are better in math, and that can have a tremendous impact on individual girls who are told to stay away from engineering or the physical sciences because 'Girls can't do the math.'"

Scientists now know that stereotypes affect performance, Hyde adds. "There is lots of evidence that what we call 'stereotype threat' can hold women back in math. If, before a test, you imply that the women should expect to do a little worse than the men, that hurts performance. It's a self-fulfilling prophecy.

"Parents and teachers give little implicit messages about how good they expect kids to be at different subjects," Hyde adds, "and that powerfully affects their self-concept of their ability. When you are deciding about a major in physics, this can become a huge factor."

Hyde hopes the new results will slow the trend toward single-sex schools, which are sometimes justified on the basis of differential math skills. It may also affect standardized tests, which gained clout with the passage of No Child Left Behind, and tend to emphasize lower-level math skills such as multiplication, Hyde says.

"High-stakes testing really needs to include higher-level problem-solving, which tends to be more important in jobs that require math skills. But because many teachers teach to the test, they will not teach higher reasoning unless the tests start to include it."

The new findings reinforce a recent study that ranked gender dead last among nine factors, including parental education, family income, and school effectiveness, in influencing the math performance of 10-year-olds.



Hyde acknowledges that women have made significant advances in technical fields. Half of medical school students are female, as are 48 percent of undergraduate math majors. "If women can't do math, how are they getting these majors?" she asks.

Because progress in physics and engineering is much slower, "we have lots of work to do," Hyde says. "This persistent stereotyping disadvantages girls. My message to parents is that they should have confidence in their daughter's math performance. They need to realize that women can do math just as well as men. These changes will encourage women to pursue occupations that require lots of math."

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University of Wisconsin-Madison**. The original article was written by David Tenenbaum.

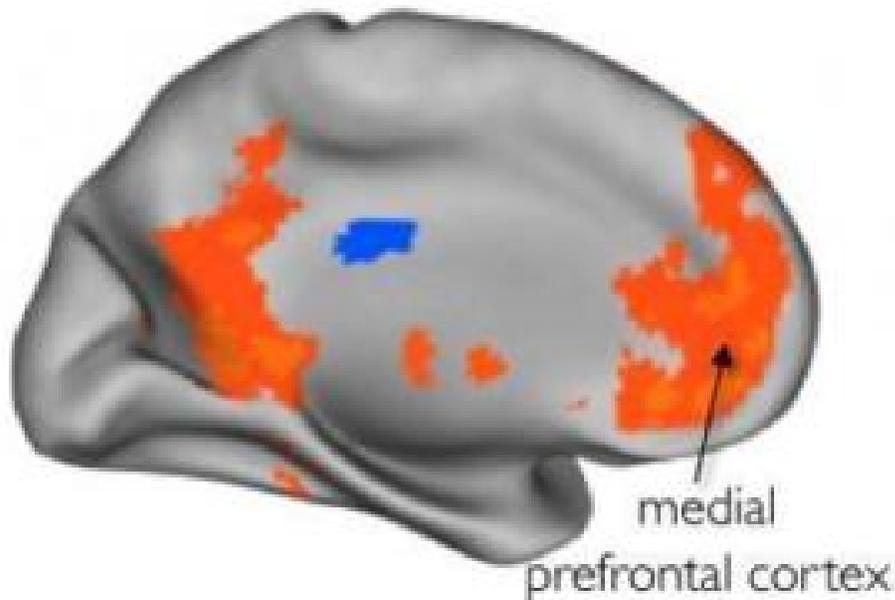
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<http://www.sciencedaily.com/releases/2010/10/101011223927.htm>}}

## Brain Responds More to Close Friends, Imaging Study Shows



Brain regions that respond to information about friends are shown in orange and overlap a network of regions known to process personally relevant stimuli; regions that respond more to strangers are in blue. Notably, whether the person was perceived to be similar to the participant made no difference in brain response, suggesting that social alliances outweigh common interests. (Credit: Courtesy, with permission: Krienen et al. *The Journal of Neuroscience* 2010.)

ScienceDaily (Oct. 12, 2010) — People's brains are more responsive to friends than to strangers, even if the stranger has more in common, according to a study in the Oct. 13 issue of *The Journal of Neuroscience*. Researchers examined a brain region known to be involved in processing social information, and the results suggest that social alliances outweigh shared interests.

In a study led by graduate student Fenna Krienen and senior author Randy Buckner, PhD, of Harvard University, researchers investigated how the medial prefrontal cortex and associated brain regions signal someone's value in a social situation. Previous work has shown that perceptions of others' beliefs guide social interactions. Krienen and her colleagues wondered whether these brain regions respond more to those we know, or to those with whom we share similar interests.

"There are psychological and evolutionary arguments for the idea that the social factors of 'similarity' and 'closeness' could get privileged treatment in the brain; for example, to identify insiders versus outsiders or kin versus non-kin," Krienen said. "However, these results suggest that social closeness is the primary factor, rather than social similarity, as previously assumed."

The researchers first imaged the brain activity of 32 participants as they judged how well lists of adjectives described their personalities. This helped to identify brain regions that respond to personally relevant information. In separate experiments, 66 different participants provided personality information about themselves and two friends -- one friend whom they believed had similar preferences and one believed to be dissimilar.

The authors made up biographies of similar and dissimilar strangers for each volunteer based on their personality profiles. Then, while in a scanner, they played a game similar to the TV show "The Newlywed Game," in which participants predicted how another person would answer a question. For example, would a friend or stranger prefer an aisle or window seat on a flight?



The authors found activity in the medial prefrontal cortex increased when people answered questions about friends. Notably, whether the person had common interests made no difference in brain response.

"In all experiments, closeness but not similarity appeared to drive responses in medial prefrontal regions and associated regions throughout the brain," Krienen said. "The results suggest social closeness is more important than shared beliefs when evaluating others."

Read Montague, PhD, of Baylor College of Medicine, an expert on decision-making and computational neuroscience, said the study's large number of participants and experimental approach makes it a solid contribution to the field. "The authors address an important component of social cognition -- the relevance of people close to us," Montague said.

The research was supported by the National Institute on Aging, the Howard Hughes Medical Institute, the Simons Foundation, the U.S. Department of Defense, and an Ashford Graduate Fellowship in the Sciences.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

#### Story Source:

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Society for Neuroscience**, via **EurekAlert!**, a service of AAAS.

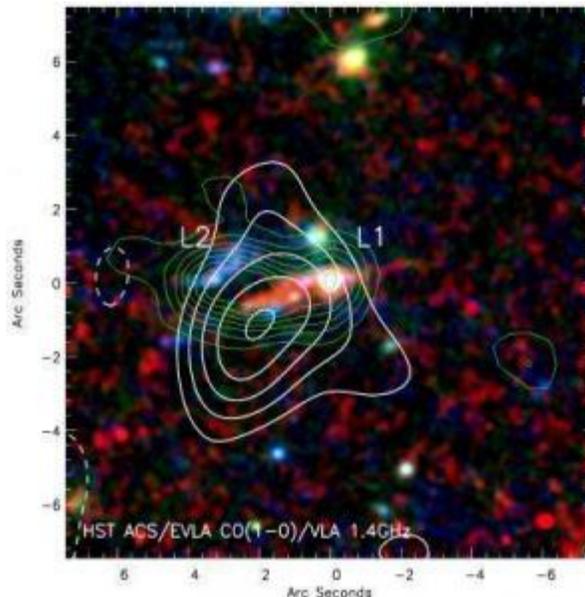
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1. Fenna M. Krienen, Pei-Chi Tu, and Randy L. Buckner. **Clan Mentality: Evidence That the Medial Prefrontal Cortex Responds to Close Others.** *Journal of Neuroscience*, 2010; 30: 13906-13915 DOI: [10.1523/JNEUROSCI.2180-10.2010](https://doi.org/10.1523/JNEUROSCI.2180-10.2010)

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## Wild 'Teenage' Galaxies Booming With Star Births



This is an example of a teenage galaxy. The white contours show the new measurements of carbon emissions, which have led to a drastic reassessment of the gas mass of these young galaxies. (Credit: Ivison et al. 2010) ScienceDaily (Oct. 13, 2010) — Scientists from the Niels Bohr Institute have been studying distant galaxies, which are among the most active star-forming galaxies in the Universe. They form around 1,000 new stars a year -- a 1,000 times more than our own galaxy, the Milky Way.

The findings have been published in *Monthly Notices of the Royal Astronomical Society*.

"The galaxies are located in the far distant Universe -- when the universe was 3 billion years old (equivalent to only 20 percent of its current age). It is a period of the Universe when the galaxies were very active, almost teenager-like and out of control," describes Thomas R. Greve, Associate professor in astrophysics at Dark Cosmology Centre, Niels Bohr Institute at the University of Copenhagen.

Together with researchers from the Royal Observatory, Edinburgh and Durham University in England, he has studied the distant galaxies using the Expanded Very Large Array, which is an astronomical observatory in New Mexico, USA. The observatory consists of 27 parabolic antennas, each of which have a diameter of 25 meters and can measure radio waves from distant objects. Data from each antenna is combined electronically so that the final measurements have an angular resolution equivalent to a single antenna with a diameter of 36 km and a sensitivity equal to that of a single antenna with a diameter of 130 meters.

"We have measured the CO levels, that is to say carbon monoxide, which is one of the most common molecules in the universe, after the hydrogen molecule, H<sub>2</sub>. Using the measurements we have calculated how much gas there is in the galaxy and it turns out there are extremely large amounts of gas in these galaxies," explains Thomas R. Greve.

### Raw material for new stars

Gas is the raw material used in the Universe to form stars. In the galaxies the gas collects in large clouds, which become denser and denser as a result of their own gravitational pull. Eventually, the gas becomes so dense that it collapses into a ball of glowing gas, which forms a new star -- the cloud almost 'explodes' in a cosmic firework display of new stars.

"What is new about our observations is that we have looked at the amount of cold, diffuse gas that is not yet actively star-forming, and what we can determine is that there is more than twice as much gas than previously thought. This means that there is an enormous amount of raw material, which can condense and form new stars," explains Thomas R. Greve.



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The measurements of the morphology of the gas also suggest that these galaxies are not only bigger than we thought, but also very irregular in their shape. It is only much later (several hundred billion years) in their development, after they have undergone their intense star formation that they become the mature, regular, elliptical shaped galaxies that we see in our Universe today.

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University of Copenhagen**, via EurekAlert!, a service of AAAS.

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**Journal Reference:**

1. R. J. Ivison, P. P. Papadopoulos, Ian Smail, T. R. Greve, A. P. Thomson, E. M. Xilouris, S. C. Chapman. **Tracing the molecular gas in distant submillimetre galaxies via CO(1-0) imaging with the EVLA.** *Monthly Notices of the Royal Astronomical Society*, 2010; (submitted) [[link](#)]

<http://www.sciencedaily.com/releases/2010/10/101012101619.htm>

## Monarch Butterflies Use Medicinal Plants to Treat Offspring for Disease



*Monarch butterfly egg on a milkweed plant leaf. (Credit: iStockphoto)*

ScienceDaily (Oct. 12, 2010) — Monarch butterflies appear to use medicinal plants to treat their offspring for disease, research by biologists at Emory University shows. Their findings were published online Oct. 6 in the journal *Ecology Letters*.

"We have shown that some species of milkweed, the larva's food plants, can reduce parasite infection in the monarchs," says Jaap de Roode, the evolutionary biologist who led the study. "And we have also found that infected female butterflies prefer to lay their eggs on plants that will make their offspring less sick, suggesting that monarchs have evolved the ability to medicate their offspring."

Few studies have been done on self-medication by animals, but some scientists have theorized that the practice may be more widespread than we realize. "We believe that our experiments provide the best evidence to date that animals use medication," de Roode says.

"The results are also exciting because the behavior is trans-generational," says Thierry Lefevre, a post-doctoral fellow in de Roode's lab. "While the mother is expressing the behavior, only her offspring benefit. That finding is surprising for monarch butterflies."

The findings also may have implications for human health, says University of Michigan chemical ecologist Mark Hunter, who collaborated with de Roode's group on the research.

"When I walk around outside, I think of the plants I see as a great, green pharmacy," Hunter says. "But what also strikes me is how little we actually know about what that pharmacy has to offer. Studying organisms engaged in self-medication gives us a clue as to what compounds might be worth investigating for their potential as human medicines."

Monarch butterflies are known for their spectacular migration from the United States to Mexico each year, and for the striking pattern of orange, black and white on their wings. That bright coloration is a warning sign to birds and other predators that the butterfly may be poisonous.

Monarch caterpillars feed on any of dozens of species of milkweed plants, including some species that contain high levels of cardenolides. These chemicals do not harm the caterpillars, but make them toxic to predators even after they emerge as adults from their chrysalises.

Previous research has focused on whether the butterflies choose more toxic species of milkweed to ward off predators. De Roode wondered if the choice could be related to the *Ophryocystis elektroscirrha*. The parasites invade the gut of the caterpillars and then persist when they become adult monarchs. An infected female passes on the parasites when she lays her eggs. If the adult butterfly leaves the pupal stage with a severe



parasitic infection, it begins oozing fluids from its body and dies. Even if the butterflies survive, they do not fly as well or live as long as uninfected ones.

Experiments in de Roode's lab have shown that a female infected with the parasites prefers to lay her eggs on a toxic species of milkweed, rather than a non-toxic species. Uninfected female monarchs, however, showed no preference.

Researchers have studied the kinds of leaves that primates eat in forests, but this work with butterflies stresses the point that even insects in our own back yard can be useful indicators of what might be medicinally active, Hunter says.

De Roode recently received a \$500,000 grant from the National Science Foundation, which he will use to see if the lab results can be replicated in nature, in different populations of monarchs in various regions of the world. Hunter received \$150,000 from the NSF to identify the chemicals that account for the medicinal properties of the milkweed plants.

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**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **Emory University**, via EurekAlert!, a service of AAAS.

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**Journal Reference:**

1. Thierry Lefèvre, Lindsay Oliver, Mark D. Hunter and Jacobus C. De Roode. **Evidence for trans-generational medication in nature.** *Ecology Letters*, 2010; DOI: [10.1111/j.1461-0248.2010.01537.x](https://doi.org/10.1111/j.1461-0248.2010.01537.x)

<http://www.sciencedaily.com/releases/2010/10/101011090010.htm>

## Rare Melt Key to 'Ring of Fire'



*Scientists investigated why the world's explosive volcanoes are confined to bands only a few tens of kilometres wide. (Credit: iStockphoto/James Steidl)*

ScienceDaily (Oct. 11, 2010) — Oxford University scientists have discovered the explanation for why the world's explosive volcanoes are confined to bands only a few tens of kilometres wide, such as those along the Pacific 'Ring of Fire'. Most of the molten rock that comes out of these volcanoes is rich in water, but the Oxford team has shown that the volcanoes are aligned above narrow regions in the mantle where water-free melting can take place. They publish a report of their research in the journal *Nature*.

These volcanic chains have been responsible for the most devastating eruptions in history, such as that of Krakatoa in 1883, and the huge eruption of Toba about 74,000 years ago, whose aftermath may have come close to extinguishing the human race.

'It has been recognised for almost 50 years that the volcanic arcs form where one oceanic plate sinks beneath another,' said Professor Philip England of Oxford University's Department of Earth Sciences, an author of the report, 'but while many models of this process have been put forward, none has been able to explain the location, and narrowness, of the volcanic arcs.'

The eruptions of volcanoes in the Ring of Fire are extremely violent (in contrast with the relatively gentle eruption in Iceland that paralysed European air travel in April) because the molten rock contains a high proportion of water which, as superheated gas, provides the power for the explosive eruptions. This water is liberated from the plates descending beneath the volcanoes and lowers the melting point of rocks in the mantle.

'Most previous explanations for the origins of volcanoes suggested that this kind of 'wet' melting is responsible for getting a volcano started,' said Dr Richard Katz of Oxford University's Department of Earth Sciences, an author of the report. The difficulty with such explanations is that wet melting occurs over very broad regions of the mantle, inconsistent with the narrowness of the volcanic chains. 'However, we noticed



that there is a very simple geometrical pattern in the distribution of the volcanoes which provides a powerful clue as to what is going on,' added Dr Katz.

Using a mathematical model of heat transport in the regions where two plates collide, the Oxford team showed that the observed geometrical pattern can only be explained if the volcanoes are localized above the narrow regions in which mantle melts in the absence of water. Melt rising from this region blazes a trail for more water-rich magma to follow all the way to the surface where it erupts to form volcanoes.

In addition to hosting devastating eruptions, the volcanic chains hold valuable clues to the evolution of the earth, because they are the surface expressions of a gigantic chemical factory in which molten rock separates from the mantle to solidify as the crust we live on, and from which significant volumes of gas are emitted into the atmosphere. The team now intends to investigate the implications of their results for the chemical processes happening deep beneath the volcanic chains.

A report of the research, 'Melting above the anhydrous solidus controls the locations of volcanic arcs', is published in *Nature* on 7 October.

#### **Background Information**

The world's major explosive volcanoes are found in chains, hundreds to thousands of kilometers in length, but a few tens of kilometers wide, close to the edges of oceans. The best-known of these form the "Ring of Fire," which stretches around the Pacific ocean from southernmost Chile, via Alaska and Japan, to New Zealand. There are other important chains, particularly in Indonesia, where Krakatoa and Toba are found. The eruptions of Vesuvius, which buried Pompeii in AD79, and of Santorini, which wiped out the Minoan culture on that island in about 1620BC, took place in the small volcanic arcs of southern Italy and the Aegean, respectively.

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#### **Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **University of Oxford**.

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#### **Journal Reference:**

1. Philip C. England, Richard F. Katz. **Melting above the anhydrous solidus controls the location of volcanic arcs.** *Nature*, 2010; 467 (7316): 700 DOI: [10.1038/nature09417](https://doi.org/10.1038/nature09417)

<http://www.sciencedaily.com/releases/2010/10/101011161038.htm>

## Can Hungary's Red Sludge Be Made Less Toxic With Carbon?



*The bauxite residue holding pond (orange, middle), near Kolontar, Hungary (left), burst on Oct. 4, 2010, leading to human casualties and intense environmental damage. Shown is the area before the spill. (Credit: Image courtesy of Google Earth)*

ScienceDaily (Oct. 13, 2010) — The red, metal-laden sludge that escaped a containment pond in Hungary last week could be made less toxic with the help of carbon sequestration, says an Indiana University Bloomington geologist who has a patent pending on the technique.

The bauxite residue now covers 40 square kilometers south of the Danube River, and has caused the deaths of eight Hungarians and injured at least 150. The residue also has caused the extinction of life in a local river and as yet unknown environmental damage elsewhere. While human deaths in the wake of the disaster may have been strictly a result of the containment failure, injuries have mostly been attributed to the chemical properties of the sludge, whose high pH (between 11 and 13) can quickly damage and kill living cells. Bauxite residue is between 10,000 and 1,000,000 times more basic than pure water, which has a pH around 7.

"We propose one way to reduce the pH of bauxite residue is to mix it with another kind of industrial waste -- oil-field brine, which is a by-product of oil and gas production -- and then carbon dioxide," said IU Bloomington geologist Chen Zhu, who submitted a U.S. Department of Energy patent application in 2007 describing the technique.

The water-based brine provides the medium for carbon dioxide to dissolve. Once dissolved, the carbon dioxide can chemically react with water to form carbonic acid. The carbonic acid counteracts some of the red mud's alkalinity, and what's left -- the negatively charged carbonate -- can serve as a partner for positively charged metal ions, such as iron, calcium and magnesium. Some of these salts spontaneously precipitate out of solution, which is a good thing, since the metals in these salts will longer will be free to interact with, say, living matter.



Bauxite residue, sometimes called "red sludge" or the more euphemistic "red mud," is the waste created by industries that produce aluminum. At present, the residues simply accrue in containment ponds. Worldwide, there are in excess of 200 million tons in these ponds.

"Companies don't voluntarily spend money to neutralize waste unless someone tells them to do it, sadly," Zhu said. "Our technique could be quite expensive. When you have a disaster like the one we're seeing in Hungary, though, I think perhaps companies and governments may think twice about what 'too expensive' means."

The combination of bauxite residue and oil-field brine is a novel approach to waste disposal, but this isn't an instance where the combination of two negatives equals a positive. It's more of a less-negative, Zhu says.

"By reducing the pH and causing the precipitation of problematic salts, what we're left with is not something that's non-toxic, but less toxic than what we started with," he says. "Every year millions of tons of bauxite residues are being generated by industry around the world. Disposal ponds are where most of it goes. There is a great need for research on how to improve disposal."

Zhu is working with the American aluminum producer Alcoa and the Department of Energy to perfect the technology.

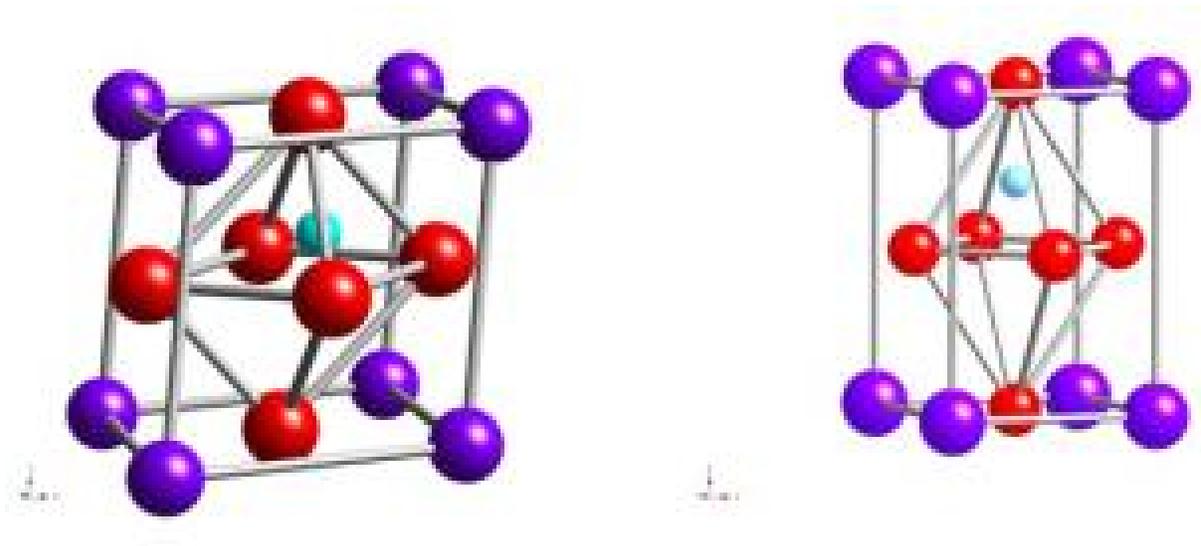
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**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **Indiana University**.

<http://www.sciencedaily.com/releases/2010/10/101013122603.htm>

## Potential of Lead-Free Piezoelectric Ceramics



*Crystal structure of KNBT before the application of an electric field (left) and after (right). The purple spheres are either sodium or potassium atoms, the red spheres are oxygen atoms, the small blue sphere is titanium. The figures show the arrangement of the atoms changing from rhombohedral, where the  $a$ ,  $b$  and  $c$  axes are of the same length and rhombohedral angle is less than  $90^\circ$ , to tetragonal symmetry, where the  $a$  and  $b$  axes are of the same length and the  $c$  axis is longer. (Credit: Image courtesy of Diamond Light Source Ltd)*

ScienceDaily (Oct. 4, 2010) — Scientists are using Diamond Light Source, the UK's national synchrotron facility, to discover how we can detoxify our electronic gadgets. Results published in the journal *Applied Physics Letters* reveal the potential for new artificial materials that could replace lead-based components in everyday products from inkjet printers to digital cameras.

Researchers from the Institute for Materials Research at the University of Leeds' Faculty of Engineering used the Diamond synchrotron to investigate the structure and properties of piezoelectric ceramics in order to develop more environmentally friendly alternatives to the widely-used but toxic ceramic crystal lead zirconium titanate (PZT).

The team used the I15 Extreme Conditions beamline at Diamond to probe the interior crystal structure of the ceramics with a high-energy pinpoint X-ray beam and saw changes in the crystal structure as an electric field was applied. Their results demonstrate that this new material, potassium sodium bismuth titanate (KNBT), shows the potential to perform the same job as its lead counterpart.

Dr Tim Comyn, lead investigator on the project, said: "These results are very encouraging. Although harmless when in use, at the end of their lifetime these PZT gadgets have to be carefully disposed of due to their lead content and as a consequence, there is significant interest in developing lead-free ceramics."

Piezoelectric materials generate an electrical field when pressure is applied, and vice versa. For example in gas igniters, like those used on ovens and fires, a piezoelectric crystal creates sparks when hit with the hammer. In an electrical field, it undergoes a phase transition, that is changes in the crystal structure.

The team will continue to work at Diamond to study the electric field induced transformation at high speed (1000 times per second) and under various conditions using state of the art detectors.

Adam Royles, PhD student on the project, said: "Not only could a lead-free solution mean safer disposal of electronic equipment, by virtue of the absence of lead, these new materials are far lighter than PZT. The piezoelectric market has applications in many fields, where a lighter lead-free alternative could make quite a difference."



In the medical field, PZT is used in ultrasound transducers, where it generates sound waves and sends the echoes to a computer to convert into a picture. Piezoelectric ceramics also hold great potential for efficient energy harvesting, a possible solution for a clean sustainable energy source in the future.

Lead-based electronic ceramics are one of only a few exemptions to the European directive on the restriction of the use of certain hazardous substances in electrical and electronic components (2002/95/EC). This exemption will be reviewed again in 2012.

The global market for piezoelectric-operated actuators and motors was estimated to be \$6.6 billion in 2009 and is estimated to reach \$12.3 billion by 2014.

**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Diamond Light Source Ltd.**

**Journal Reference:**

1. A. J. Royles, A. J. Bell, A. P. Jephcoat, A. K. Kleppe, S. J. Milne, T. P. Comyn. **Electric-field-induced phase switching in the lead free piezoelectric potassium sodium bismuth titanate.** *Applied Physics Letters*, 2010; 97 (13): 132909 DOI: [10.1063/1.3490235](https://doi.org/10.1063/1.3490235)

<http://www.sciencedaily.com/releases/2010/10/101005085614.htm>

## Melanoma Drug Shrinks Brain Metastases in Phase I/II Study

ScienceDaily (Oct. 10, 2010) — A new drug being developed to treat potentially deadly melanoma skin cancers has shown a promising ability to shrink secondary tumors, known as metastases, in the brain in patients with advanced forms of the disease, Australian researchers report.

At the 35th Congress of the European Society for Medical Oncology (ESMO), Dr Georgina Long from Melanoma Institute Australia and Westmead Hospital, in Sydney, reported the results in a subgroup of 10 melanoma patients with previously untreated brain metastases from the international Phase I/II trial with the oral drug GSK2118436.

"Brain metastases in melanoma are a major unsolved problem," Dr Long said. "We are very excited about the robust activity seen with GSK2118436 in this Phase I/II trial so far. Until now, melanoma has been notoriously resistant to drug therapy in general, and responses in highly lethal brain metastases are particularly uncommon."

Of all solid tumors, melanoma has the greatest capacity to spread via the blood stream to the brain. Overall, 15 to 20% of patients with melanoma that has spread beyond the skin have brain metastases at initial diagnosis, and nearly 75% have them at autopsy.

Currently, there is no evidence that any therapy prolongs survival in patients with multiple melanoma brain metastases. The median overall survival time for all patients with melanoma brain metastases is 16 weeks from diagnosis of brain involvement.

Dr Long and colleagues are testing GSK2118436 as a potential treatment for melanoma patients who have a particular common mutation of the gene for a protein called BRAF, which is mutated in 50% of human melanomas. The drug binds to the activated form of the BRAF protein in the melanoma cell, causing the cell to stop proliferating, and in many cases, die.

The data being presented at ESMO comes from a sub-group of 10 trial participants with previously untreated brain metastases. All 10 patients experienced control of melanoma brain metastases, and 9 of the 10 patients had reductions in the overall size of their brain metastases, Dr Long reported. The overall reductions ranged from 20 to 100% of brain metastases that were 3mm or larger in diameter before treatment.

In this Phase I/II trial, this drug showed a similar effect in patients with melanoma outside the brain, Dr Long said. "We have previously reported a response rate of more than 60% which is unusually good."

"The ability to inhibit oncogenic BRAF is the most important development in the history of drug treatment of melanoma," Dr Long added. "Providing these early data are supported in larger cohorts of patients, and durable responses are confirmed, this activity in the brain may assist in addressing a large unmet need in patients with metastatic melanoma."

The Australian researchers expect to present an update of activity and safety in all subjects of the Phase I/II trial in November 2010 at the meeting of the Society for Melanoma Research in Sydney. They are also planning a Phase II study of the drug in melanoma patients with V600 BRAF mutant metastatic melanoma involving the brain. They hope to open that second trial in November or December 2010.

*Editor's Note: This article is not intended to provide medical advice, diagnosis or treatment.*

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### Story Source:

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **European Society for Medical Oncology**, via [EurekAlert!](#), a service of AAAS.

<http://www.sciencedaily.com/releases/2010/10/101012101849.htm>

## Surgical Technique Relieves Painful Spine Fractures in Patients With Metastatic Cancer

ScienceDaily (Oct. 9, 2010) — A surgical technique appears to offer quick and effective relief for debilitating spinal fractures often suffered by patients with metastatic cancer, researchers reported at the 35th Congress of the European Society for Medical Oncology (ESMO) in Milan.

Many patients with multiple myeloma, or those whose cancer has spread beyond the initial tumor site, suffer compression fractures in their spine. This is partly because the spine is one of the most common sites for metastatic spread of the disease, making the vertebrae brittle and at risk for fractures. Widely-used cancer treatments such as corticoid treatment, hormone therapy, radiation therapy can also have a weakening effect on bone and increase the risk for fractures in these patients.

Professor Leonard Bastian from Klinikum Leverkusen in German led an international trial testing a new technique to treat these compression fractures, called balloon kyphoplasty.

"Balloon Kyphoplasty is a minimally invasive surgical procedure to treat patients with painful vertebral compression fractures," Prof Bastian explained.

To perform the procedure, a surgeon inserts a small orthopedic balloon through a 1 cm incision into the fractured vertebra. Inflation of the balloon can restore the shape and height of the vertebrae. The balloon is then deflated and removed and a precise amount of quick-setting bone cement is injected in the vertebral body restoring the shape and strength of the vertebrae.

At the congress, Prof Bastian reported the results of a trial including 134 patients randomly assigned to either balloon kyphoplasty (70 patients) or non-surgical management (64).

Those who had the surgery showed improvements in a questionnaire designed to measure their level of disability at one month after surgery. They also experienced a significant improvement in back pain one week after surgery, while those who received non-surgical management saw no improvement.

After one month, patients in the non-surgical arm of the study were allowed to receive balloon kyphoplasty. Thirty-eight chose to do so. All patients who underwent balloon kyphoplasty reported sustained improvements in quality of life for a year after treatment.

"Balloon kyphoplasty offers quick pain relief; restores patient activity and mobility and it gives an important improvement of quality of life," Prof Bastian said. "It may be the right treatment option for vertebral compression fractures if conventional pain medication has not been effective or has too many side-effects."

"This study demonstrates balloon kyphoplasty should be considered when painful vertebral compression fractures occur in cancer patients. It is an additional therapy which can really add to the patient's quality of life."

"The role of balloon kyphoplasty for the control of pain and disability in cancer patients is a hot topic," commented Dr Fausto Roila from Ospedale Santa Maria, Terni, Italy. "Managing the side-effects of therapies and the symptoms of cancer is an important aspect of cancer care."

The study by Prof Bastian's group adds to a growing literature on the role of kyphoplasty, Dr Roila noted. "As research into this technique continues it will be important to conduct double-blind, placebo-controlled studies to identify the place of balloon kyphoplasty in cancer care."

*Editor's Note: This article is not intended to provide medical advice, diagnosis or treatment.*

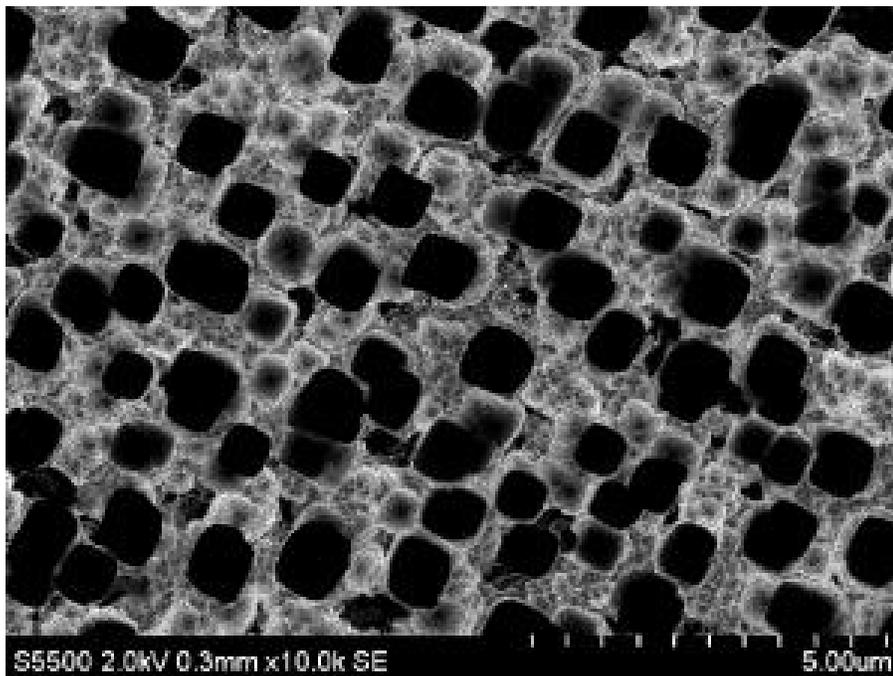
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### Story Source:

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **European Society for Medical Oncology**, via [EurekAlert!](#), a service of AAAS.

<http://www.sciencedaily.com/releases/2010/10/101009082819.htm>

## Silicon Strategy Shows Promise for Batteries: Lithium-Ion Technique for Electric Cars, Large-Capacity Storage



*Microscopic pores dot a silicon wafer prepared for use in a lithium-ion battery. Silicon has great potential to increase the storage capacity of batteries, and the pores help it expand and contract as lithium is stored and released. (Credit: Biswal Lab/Rice University)*

ScienceDaily (Oct. 13, 2010) — A team of Rice University and Lockheed Martin scientists has discovered a way to use simple silicon to radically increase the capacity of lithium-ion batteries.

Sibani Lisa Biswal, an assistant professor of chemical and biomolecular engineering, revealed how she, colleague Michael Wong, a professor of chemical and biomolecular engineering and of chemistry, and Steven Sinsabaugh, a Lockheed Martin Fellow, are enhancing the inherent ability of silicon to absorb lithium ions. Their work was introduced at Rice's Buckyball Discovery Conference, part of a yearlong celebration of the 25th anniversary of the Nobel Prize-winning discovery of the buckminsterfullerene, or carbon 60, molecule. It could become a key component for electric car batteries and large-capacity energy storage, they said.

"The anode, or negative, side of today's batteries is made of graphite, which works. It's everywhere," Wong said. "But it's maxed out. You can't stuff any more lithium into graphite than we already have."

Silicon has the highest theoretical capacity of any material for storing lithium, but there's a serious drawback to its use. "It can sop up a lot of lithium, about 10 times more than carbon, which seems fantastic," Wong said. "But after a couple of cycles of swelling and shrinking, it's going to crack."

Other labs have tried to solve the problem with carpets of silicon nanowires that absorb lithium like a mop soaks up water, but the Rice team took a different tack.

With Mahduri Thakur, a post-doctoral researcher in Rice's Chemical and Biomolecular Engineering Department, and Mark Isaacson of Lockheed Martin, Biswal, Wong and Sinsabaugh found that putting micron-sized pores into the surface of a silicon wafer gives the material sufficient room to expand. While common lithium-ion batteries hold about 300 milliamp hours per gram of carbon-based anode material, they determined the treated silicon could theoretically store more than 10 times that amount.

Sinsabaugh described the breakthrough as one of the first fruits of the Lockheed Martin Advanced Nanotechnology Center of Excellence at Rice (LANCER). He said the project began three years ago when he

met Biswal at Rice and compared notes. "She was working on porous silicon, and I knew silicon nanostructures were being looked at for battery anodes. We put two and two together," he said. Nanopores are simpler to create than silicon nanowires, Biswal said. The pores, a micron wide and from 10 to 50 microns long, form when positive and negative charge is applied to the sides of a silicon wafer, which is then bathed in a hydrofluoric solvent. "The hydrogen and fluoride atoms separate," she said. "The fluorine attacks one side of the silicon, forming the pores. They form vertically because of the positive and negative bias."

The treated silicon, she said, "looks like Swiss cheese."

The straightforward process makes it highly adaptable for manufacturing, she said. "We don't require some of the difficult processing steps they do -- the high vacuums and having to wash the nanotubes. Bulk etching is much simpler to process.

"The other advantage is that we've seen fairly long lifetimes. Our current batteries have 200-250 cycles, much longer than nanowire batteries," said Biswal.

They said putting pores in silicon requires a real balancing act, as the more space is dedicated to the holes, the less material is available to store lithium. And if the silicon expands to the point where the pore walls touch, the material could degrade.

The researchers are confident that cheap, plentiful silicon combined with ease of manufacture could help push their idea into the mainstream.

"We are very excited about the potential of this work," Sinsabaugh said. "This material has the potential to significantly increase the performance of lithium-ion batteries, which are used in a wide range of commercial, military and aerospace applications

Biswal and Wong plan to study the mechanism by which silicon absorbs lithium and how and why it breaks down. "Our goal is to develop a model of the strain that silicon undergoes in cycling lithium," Wong said.

"Once we understand that, we'll have a much better idea of how to maximize its potential."

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **Rice University**, via EurekAlert!, a service of AAAS.

<http://www.sciencedaily.com/releases/2010/10/101013161944.htm>

## Despite Brain Damage, Working Memory Functions -- Within Limits

ScienceDaily (Oct. 12, 2010) — Researchers at the University of California, San Diego School of Medicine, led by Larry R. Squire, PhD, professor of psychiatry, psychology and neurosciences at UC San Diego and a scientist at the VA San Diego Healthcare System, report that working memory of relational information -- where an object is located, for example -- remains intact even if key brain structures like the hippocampus are damaged.

The findings, published in the Oct. 13, 2010 issue of *The Journal of Neuroscience*, run contrary to previous research that suggested spatial information, especially if it's linked to other kinds of information, necessarily involves the hippocampus and other regions associated with memory.

Working memory is the mental ability to hold small amounts of information in an active, readily available state for a short period of time, typically a few seconds. Conversely, long-term memory involves storing a potentially unlimited amount of information for an indefinite period of time.

Squire and colleagues examined four memory-impaired patients with damage to their medial temporal lobes (MTL), a region of the cerebral cortex containing the hippocampus and linked to long-term memory formation.

The four patients were asked to briefly study an arrangement of objects on a table, then reproduce the objects' relative positions on another table. When the number of objects was three or less, the patients' ability to recall was similar to that of control subjects without brain damage. The impaired patients easily remembered where the objects had been placed in relation to each other.

But "their performance abruptly collapsed when the limit of working memory was reached," said Squire. The patients could not remember the locations of four or more objects because doing so involved tapping into long-term memory functions in the medial temporal lobe.

"The findings provide strong evidence for a fundamental distinction in the brain between working memory and long-term memory, even in the realm of spatial information and spatial-object associations," Squire said. The work has practical and clinical significance as well, according to Squire.

"It indicates that patients with memory impairment due to MTL damage, including early stage Alzheimer's disease, have a narrower difficulty than what one might have thought. They have an intact ability to hold information in mind, and an ability to work with it on a temporary basis."

Co-authors of the paper are Annette Jeneson of the UCSD Department of Psychology, and Kristin N. Mauldin of the UCSD Department of Psychiatry.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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### Story Source:

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University of California -- San Diego**, via **EurekAlert!**, a service of AAAS.

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### Journal Reference:

1. Annette Jeneson, Kristin N. Mauldin, and Larry R. Squire. **Intact Working Memory for Relational Information after Medial Temporal Lobe Damage.** *Journal of Neuroscience*, 2010; 30: 13624-13629  
DOI: [10.1523/JNEUROSCI.2895-10.2010](https://doi.org/10.1523/JNEUROSCI.2895-10.2010)

<http://www.sciencedaily.com/releases/2010/10/101012173220.htm>



## Computer 'Trained' to Classify Pictures and Videos Basing on Elements They Contain

ScienceDaily (Oct. 13, 2010) — University of Granada researchers have developed a new computer technique that allows to "train" computers to interpret the visual contents of a video or picture. This advance will allow to classify automatically pictures basing on whether individuals or specific objects are present in such images. Videos can also be classified according to specific poses.

At present, computer search and classification of images is made basing on the name of the file, folder or on features as date or size, but the visual information contained was never used for classification purposes. This study conducted by the University of Granada will allow to employ this parameter in the short term for classifying videos according to actions performed by individuals.

The research conducted by Manuel Jesús Marín Jiménez, who is currently working at the University of Córdoba, and coordinated by Professor Nicolás Pérez de la Blanca Capilla, Department of Computing and Artificial Intelligence, University of Granada.

### A Specific Pose

Apart from detecting individuals in TV video/film shots, this new technique allows to estimate the position of upper limbs (head, chest, arms and forearms) and the automatic classification of video scenes where people appear in a specific pose. Human actions such as walking, jumping, bending down, etc. can also be detected in video sequences.

As Marín Jiménez explains, currently, there is great interest in important international companies as Microsoft or Google in making computers interpret automatically the visual contents of images and video. "Our work is a contribution towards progress in this demanding challenge," the researcher states.

The results of this research have been presented in a number of international conferences such as the *International Conference in Pattern Recognition* (2006), and the conference on *Computer Vision and Pattern Recognition* (2008 and 2009).

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### Story Source:

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University of Granada**, via [AlphaGalileo](#).

<http://www.sciencedaily.com/releases/2010/10/101013095549.htm>

## Personality and Exercise Levels May Be Linked -- Not Just in Humans, but Other Animals Too

ScienceDaily (Oct. 13, 2010) — There may be a fundamental link between aspects of an individual's personality and their capacity to exercise or generate energy, recent research suggests.

Humans are not the only animals that choose to exercise, and -- as with people -- individuals within the same species differ in their levels of activity, says Dr Peter Biro, a senior lecturer in the UNSW Evolution and Ecology Research Centre, in a review article in the journal *Trends in Ecology and Evolution*, with colleague Judy Stamps of the University of California, Davis. Dr Biro is an Australian Research Council Future Fellow.

Likewise, scientists now recognise that many animals have 'personality', in that they display consistent differences in behaviours. Dr Biro believes it is significant that those behaviours often relate to the rates at which they acquire and expend energy through feeding or activity.

"Some of us are couch potatoes while others are drawn to sport and exercise," notes Dr Biro. "We often associate the athletic 'jock' type or person with being aggressive and social, whereas the more sedentary 'nerd' often is seen as more socially awkward and submissive.

"These are generalisations, but most people would probably agree there is some truth to them. If so, why should individuals differ in their propensity for activity and in their personality, and why might they be related? "

The article reviews a wide range of recent research into these questions and concludes that there is now enough evidence to suggest a link between an individual's personality and the rate of its metabolism -- the chemical process that converts food into the energy that fuels the body.

"Animals in captivity often engage in energetically demanding behaviour when they have unlimited food available," Dr Biro says. "Mice spend considerable time on running wheels, for example, and other animals often pace back and forth in zoo enclosures. Given they don't need to move about in search of food as they would in nature, we might ask why they are apparently 'exercising'.

"Recent research suggests that this behaviour might be related to an individual's capacity to generate energy -- its 'metabolic capacity'. For example, mice in isolation that have high metabolism tend spend more time on running wheels, and run faster, than those with low metabolism.

"Male crickets with sex on their mind tend to call to attract mates more and have higher metabolism than those with slower metabolism."

Metabolism and aggression are also linked. It has now been documented, for example, in several species of fish and birds that individuals with high metabolism tend to be more aggressive and dominant over those with slow metabolism.

The amount of energy devoted to energetically demanding activities differs among individuals, Dr Biro says. These differences in energetic capacity -- along with the tendency for metabolism to be consistent over long periods -- might provide a very general explanation for personality in animals.

"It may just be that some individuals generate much more energy than others and when those individuals are captive with abundant food, they must outlet 'excess' energy that is normally expressed in nature in activities such as feeding and defence of food supplies.



"We are still some ways from a really solid understanding of the links between metabolism and personality in animals, but recent research suggests these ideas have merit and are worth studying further."

*Editor's Note: This article is not intended to provide medical advice, diagnosis or treatment.*

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University of New South Wales**. The original article was written by Bob Beale.

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**Journal Reference:**

1. Peter A. Biro, Judy A. Stamps. **Do consistent individual differences in metabolic rate promote consistent individual differences in behavior?** *Trends in Ecology & Evolution*, 2010; DOI: [10.1016/j.tree.2010.08.003](https://doi.org/10.1016/j.tree.2010.08.003)

<http://www.sciencedaily.com/releases/2010/10/101013095328.htm>

## Nicotine Could Play Role in Alzheimer's Disease Therapy, Neuroscientists Discover

ScienceDaily (Oct. 12, 2010) — A team of neuroscientists has discovered important new information in the search for an effective treatment for Alzheimer's disease, the debilitating neurological disorder that afflicts more than 5.3 million Americans and is the sixth-leading cause of death in the United States. Hey-Kyoung Lee, associate professor in the University of Maryland Department of Biology, and her research team have shown that they may be able to eliminate debilitating side effects caused by a promising Alzheimer's drug by stimulating the brain's nicotine receptors.

Scientists believe that an over-production of a peptide called A-beta in the brain is the cause of Alzheimer's and are developing drug treatments that prevent the action of the enzyme BACE1, which produces A-beta. But Lee and her team, including University of Maryland and Johns Hopkins University researchers, previously demonstrated that eliminating -- or "knocking out" -- the BACE1 enzyme in laboratory mice caused some of the test animals to become confused and aggressive.

"The mice exhibit signs of schizophrenia and memory loss when you block the enzyme," says Lee. "BACE1 is a very promising drug target, but you have to overcome these obviously debilitating side effects to effectively treat Alzheimer's disease."

Lee and her colleagues have been searching for a solution that could circumvent the abnormal brain function and behavioral side effects caused by BACE1 inhibition, and they think they may have found it. They pinpointed the receptor that is targeted by nicotine, the Alpha7 nicotinic acetylcholine receptor, as a potential therapeutic target. A paper describing their breakthrough appears in the current issue of the *Journal of Neuroscience*.

"By stimulating the Alpha7 receptor with nicotine, we were able to recover normal brain function," explains Lee. "We are very hopeful that this will be a way to overcome the deficits seen with the BACE-1 knockouts." The research group pinpointed the brain dysfunction to the regulation of calcium uptake by neurons. Calcium triggers the release of neurotransmitters, the chemicals which transmit signals from a neuron to a target cell across a synapse.

"The mice with BACE1 knockouts have less calcium signaling in the pre-synaptic neuron, and that is why they were releasing less neurotransmitters," Lee says. "We looked at what receptors on the pre-synaptic terminal were linked to a calcium signaling pathway. This Alpha7 receptor happens to be on one of the pre-synaptic receptors that is a calcium channel, and we thought we could use that to enhance the calcium signaling."

The research team found that nicotine activated the uptake of calcium, and thus the neurotransmitter release mechanism.

"After treatment with nicotine," says Lee, "the mice released normal amounts of the neurotransmitter as seen in brains of normal animals."

Lee is optimistic about the potential of this discovery, but also says that behavioral studies still need to be conducted to determine if BACE1 knockout mice treated with nicotine will behave normally. Her colleague at Johns Hopkins University, Philip C. Wong, professor of pathology and neuroscience and a co-author on this study, will be conducting these behavior studies as a follow up.

"If you tag along nicotine or anything that can activate this receptor along with the BACE1 inhibitor, then you probably can recover the function better," Lee asserts. "It is an exciting development because nicotine is an already known drug that could be easily used therapeutically with Alzheimer's treatment."



Until recently, challenges in getting a drug that could pass through the blood-brain barrier prevented the development of an effective BACE1 inhibitor drug for use in humans, but recently scientists have developed one that can be taken orally. The University of Maryland and Johns Hopkins University are filing a patent application on the therapeutic treatment that Lee and her colleagues have developed targeting the Alpha7 nicotine receptor. It is possible that this therapy may be one day packaged with BACE1 inhibitor drugs to treat Alzheimer's disease and block its progression.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University of Maryland**, via EurekAlert!, a service of AAAS.

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**Journal Reference:**

1. Hui Wang, Lihua Song, Angela Lee, Fiona Laird, Philip C. Wong, and Hey-Kyoung Lee. **Mossy Fiber Long-Term Potentiation Deficits in BACE1 Knock-Outs Can Be Rescued by Activation of Alpha7 Nicotinic Acetylcholine Receptors.** *Journal of Neuroscience*, 2010; 30: 13808-13813 DOI: [10.1523/JNEUROSCI.1070-10.2010](https://doi.org/10.1523/JNEUROSCI.1070-10.2010)

<http://www.sciencedaily.com/releases/2010/10/101013095331.htm>

## Successful Kidney Transplantation Despite Tissue Incompatibility, German Study Finds

ScienceDaily (Oct. 13, 2010) — Donor kidneys can be successfully transplanted even if there is strong tissue incompatibility between donor and recipient. An interdisciplinary working group headed by Dr. Christian Morath, senior consultant at the Department of Nephrology at Heidelberg University Hospital (Medical Director: Professor Dr. Martin Zeier) and Professor Dr. Caner Süsal, head of antibody laboratory in the Department of Transplantation Immunology, showed in a study of 34 sensitized high-risk patients that the success rate in these patients was not different from the success rate of patients with a low immunological risk.

After one year, around 95 percent of the transplants were still functioning. The researchers in Heidelberg developed a sophisticated therapy concept especially for this group of high-risk patients. This makes the transplantation center in Heidelberg the leading center in Germany in this area.

The results of the study were published in the journal *Transplantation*.

When the kidneys no longer function, patients must either undergo dialysis regularly or receive a donor kidney (transplantation). The organ comes either from a brain dead donor or a person close to the patient (live donor). The blood type and tissue compatibility factors (HLA factors) of donor and recipient should be matched as closely as possible. Since the recipient organism always attempts to reject the foreign organ, even if it has the same HLA factors, patients have to take medication after transplantation for as long as they live to suppress rejection (immunosuppression).

### Pre-operative risk assessment for high immunological risk patients

Researchers at the Heidelberg Department of Transplantation Immunology collected data over many years in the world's largest database for kidney transplantation (Collaborative Transplant Study) in order to identify patients who are at a high risk of immunological rejection. These are patients who have formed antibodies against foreign tissue, for example after pregnancies, blood transfusions, or previous transplantations, and therefore have only a slight chance of receiving a donor organ for which the tissue compatibility test (crossmatch) directly before the operation is negative. "The risk of rejecting the transplanted organ soon after the operation is especially high in this group of patients. High-risk patients can receive transplants successfully only if additional measures are taken," explained Professor Dr. Caner Süsal, head of the antibody laboratory at the Department of Transplantation Immunology.

### Same transplant survival rates as for non-immunized patients

In the current study, 34 high immunological risk patients were given plasmapheresis or immunoabsorption before and after the transplantation of a donor kidney from a brain dead (28) or live donor (6). These are procedures that remove the antibodies from the blood of the organ recipient. In addition, the patients were given a drug (Rituximab) that destroys the cells that could form new antibodies. With the help of intensive immunosuppression and close monitoring for any signs of rejection, some 95 percent of the transplanted kidneys were still functioning after one year.

Complications from the stronger immunosuppression in comparison with non-sensitized patients were rare and were easily overcome. "With the aid of the criteria we tested, we were able to transplant kidneys to patients who would formerly have needed dialysis their whole life, and at success rates corresponding to those of non-sensitized patients. Our high risk patient program is a good example of how results from research can be successfully implemented clinically after intense evaluation," Dr. Christian Morath and Dr. Jörg Beimler, senior consultant at the Department of Nephrology at Heidelberg University Hospital, were happy to report. "If we proceed according to the new methods, obstacles such as blood group incompatibility and a positive crossmatch are no longer criteria for exclusion for transplantation," added Professor Jan Schmidt, head of the division of transplantation surgery.

### Youngest patient to receive successful transplant thus far

A total of 49 patients have now been treated successfully using the regimen, most recently a child of 13 who was the youngest patient thus far to benefit from the program. "The boy is doing well and the kidney has already begun functioning completely," reported Professor Burkhard Tönshoff, chief consultant at the Center for Child and Adolescent Medicine.

### Intensive interdisciplinary cooperation is the key to success



Transplantation in high-risk patients requires the exchange of information between specialists daily or sometimes several times a day and seamless interdisciplinary communication. The excellent results show that the cooperation of various disciplines at the Heidelberg Transplantation Center functions well.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University Hospital Heidelberg**.

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**Journal Reference:**

1. Morath, Christian; Beimler, Jörg; Opelz, Gerhard; Ovens, Jörg; Scherer, Sabine; Schmidt, Jan; Schmied, Bruno; Gross, Marie-Luise; Schwenger, Vedat; Zeier, Martin; Süsal, Caner. **An Integrative Approach for the Transplantation of High-Risk Sensitized Patients.** *Transplantation*, 2010; 90 (6): 645 DOI: [10.1097/TP.0b013e3181ea3985](https://doi.org/10.1097/TP.0b013e3181ea3985)

<http://www.sciencedaily.com/releases/2010/10/101012114047.htm>

## Coral Records Show Ocean Thermocline Rise With Global Warming

*Researchers Branwen Williams and Andrea Grottoli with soft coral and black coral specimens collected offshore of Palau in the western tropical Pacific. (Credit: Image courtesy of Ohio State University)*

ScienceDaily (Oct. 11, 2010) — Researchers looking at corals in the western tropical Pacific Ocean have found records linking a profound shift in the depth of the division between warm surface water and colder, deeper water traceable to recent global warming.

The finding is the first real evidence supporting what climate modelers have been predicting as the effects of global climate change on the subsurface ocean circulation.

The report by researchers from Ohio State University and the University of Toronto was published in the latest online edition of the journal *Geophysical Review Letters*.

"We're trying to find a way to understand how the warm water in the tropical Pacific has changed in the last century, but more importantly during the last several decades," said Branwen Williams, who conducted this research while a doctoral student at Ohio State. Williams is now a postdoctoral fellow at the University of Toronto.

"The Pacific is really important since it serves as a strong driver and changes in this ocean can have a very strong impact on global climate and oceanography."

What plagues modelers and researchers alike is the limited amount of information available about the ocean when studying climate change. Satellite data and physical measurements are mainly restricted to the ocean's surface waters. What happens deeper in the waters is often an unknown.

Williams and Andrea Grottoli, an associate professor of earth sciences at Ohio State and Williams' former advisor, turned to a prolific form of soft coral, the Gorgonians, growing on a reef off the island nation of Palau.

"These corals 'sway' with the current underwater," Grottoli explained, "like trees in the wind. Since they aren't restricted to shallow and warmer surface waters like other tropical corals, they provide an opportunity to reconstruct a picture of subsurface ocean circulation in a region."

Specifically, the researchers were interested in how the boundary layer between the warmer, shallow water and the colder deeper water -- the thermocline -- has changed. But directly measuring that over time and across a broad area is impossible.

Instead, they used the soft corals as a substitute, a proxy, for determining how the thermocline rose and fell over time. Working with samples taken from corals at five meters (16.4 feet), 85 meters (279 feet) and 105 meters (345 feet), they analyzed the chemical structure of the coral skeleton that had built up over time. Slices cut through the base "trunk" of the coral revealed concentric circles resembling tree rings which showed the growth of the "trunk" over time. By analyzing material from the rings from the outer surface inward to the center, they assembled a growth record covering the last century or so.



They were looking for the ratio between two isotopes of nitrogen in the material as a clue to how the thermocline rose or fell over time. Warmer waters above the thermocline contained lower levels of nutrients resulting in organic matter with a high ratio of nitrogen-15 to nitrogen-14 isotopes. Waters below the thermocline held higher levels of nutrients resulting in organic matter with a low ratio of nitrogen-15 to nitrogen-14 isotopes.

As the polyps in the coral consumed the organic matter over the years, the nitrogen isotopes were chemically recorded in the coral. By comparing the nitrogen-15 to nitrogen-14 ratios in samples from the three depths, they could draw a picture of how the thermocline moved.

"Over several decades, specifically since the mid- to late-1970s, the records show that the mean depth of the thermocline has been getting shallower," Williams said.

The researchers did a similar analysis of the ratio of two carbon isotopes in the coral samples as well. "I think it's fair to say that the carbon isotope record supports this interpretation," Grottoli said. "It's another piece of evidence backing our conclusions."

The researchers were also looking at how the coral record meshed with the Pacific Decadal Oscillation (PDO), a long-lived pattern of climate variability similar to the El Niño phenomenon. While El Niño changes over a period of years, the PDO changes over decades.

"Climate modelers looking at how the Pacific might respond to global warming have predicted that the atmospheric patterns in the tropical Pacific would weaken, and if that happened, you would expect the thermocline to get shallower in the western tropical Pacific," Williams said.

"Our data are some of the first proxy data to support what the modelers have been predicting."

Grottoli said that the thermocline shift in the 1970s is important because it coincides with changes in the PDO from a negative phase to a positive phase.

"We think the thermocline rose when the PDO shifted," she said, "that it was a cumulative effect of both the natural variability of the PDO plus the warming global temperatures." Grottoli said that their coral record covered two other known times when the PDO shifted -- in the 1920s and 1940s when average ocean temperatures were a bit lower than today -- but neither caused a rise in the thermocline, based on their study. The researchers want to repeat their study using coral samples from other locations, moving eastward across the Pacific, to test their findings that the thermocline shift wasn't a regional phenomenon, that it is occurring all across the ocean basin, Williams said.

Along with Williams and Grottoli, Patrick Colin, director of the Coral Reef Research Foundation, assisted in the project. Support for the research came from the National Science Foundation, the PADI Foundation, the Andrew Mellon Foundation and the National Ocean Sciences Accelerator Mass Spectrometry Facility at the Woods Hole Oceanographic Institution.

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**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **Ohio State University**.

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## One in Five Children Meets Criteria for a Mental Disorder Across Their Lifetime, National U.S. Study Shows

ScienceDaily (Oct. 13, 2010) — Mental disorders in children are often difficult to identify due to the myriad of changes that occur during the normal course of maturation. For the first time, researchers at the National Institute of Mental Health have reported on the prevalence data on a broad range of mental disorders in a nationally representative sample of U.S. adolescents, which show that approximately one in five children in the U.S. meet the criteria for a mental disorder severe enough to disrupt their daily lives.

The prevalence of the mental health disorders as well as the notable link between parental mental health issues and their teen's disorders are the subject of the article by Merikangas and colleagues in the October 2010 issue of the *Journal of the American Academy of Child and Adolescent Psychiatry (JAACAP)*.

In the article titled "Lifetime Prevalence of Mental Disorders in U.S. Adolescents : Results from the National Comorbidity Study-Adolescent Supplement (NCS-A).," Dr. Merikangas and colleagues examined the lifetime prevalence, severity, and comorbidity of DSM-IV mental health disorders across broad classes of disorders.

The NCS-A is a nationally representative, face-to-face survey of 10,123 adolescents aged 13 to 18 years in the continental United States.<sup>2</sup> Diagnostic assessment of DSM-IV mental disorders were measured using a modified version of the World Health Organization (WHO) Composite International Diagnostic Interview.

The researchers found that anxiety disorders were the most common condition (31.9%), followed by behavior disorders (19.1%), mood disorders (14.3%), and substance use disorders (11.4%), with approximately 40% of participants with one class of disorder also meeting criteria for another class of lifetime disorder.

Strikingly, the overall prevalence of disorders with severe impairment and/or distress, marked by interference with daily life was over one in five children, or 22.2%.

The authors note, "The prevalence of severe emotional and behavior disorders is even higher than the most frequent major physical conditions in adolescence, including asthma or diabetes, which have received widespread public health attention."

In an era when funding allocations for science are being reduced, evaluation of nationally representative samples of children and adolescents are critical in providing the necessary information for establishing priorities for prevention, treatment, and research.

In conclusion, Merikangas and colleagues state, "The present data can inform and guide the development of priorities for future research and health policy by providing previously lacking prevalence estimates in a nationally representative sample of U.S. adolescents, as well as the individual, familial, and environmental correlates of mental disorders. Prospective research is now needed to understand the risk factors for mental disorder onset in adolescence, as well as the predictors of the continuity of these disorders into adulthood."

The National Comorbidity Survey Adolescent Supplement (NCS-A) and the larger program of related NCS surveys are supported by the National Institute of Mental Health (U01-MH60220) and the National Institute of Drug Abuse (R01 DA016558) with supplemental support from Substance Abuse and Mental Health Services Administration, the Robert Wood Johnson Foundation (Grant 044708), and the John W. Alden Trust. The NCS-A was carried out in conjunction with the World Health Organization World Mental Health Survey Initiative.

This work was supported by the Intramural Research Program of the National Institute of Mental Health. The views and opinions expressed in this article are those of the authors and should not be construed to represent the views of any of the sponsoring organizations, agencies, or U.S. Government.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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### Story Source:

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## Promising Drug Candidate Reverses Age-Related Memory Loss in Mice



*A new experimental compound that can improve memory and cognitive function in aging mice, researchers report. (Credit: iStockphoto)*

ScienceDaily (Oct. 13, 2010) — Researchers at the University of Edinburgh report a new experimental compound that can improve memory and cognitive function in aging mice. The compound is being investigated with a view to developing a drug that could slow the natural decline in memory associated with aging.

With support from a Wellcome Trust Seeding Drug Discovery award, the team has identified a preclinical candidate that they hope to take into human trials within a year.

Many people find they become more forgetful as they get older and we generally accept it as a natural part of the aging process. Absent mindedness and a difficulty to concentrate are not uncommon, it takes longer to recall a person's name, and we can't remember where we left the car keys. These can all be early signs of the onset of dementia, but for most of us it's just part of getting old.

Such memory loss has been linked with high levels of 'stress' steroid hormones known as glucocorticoids which have a deleterious effect on the part of the brain that helps us to remember. An enzyme called 11beta-HSD1 is involved in making these hormones and has been shown to be more active in the brain during aging. In a study published in the *Journal of Neuroscience*, the team reports the effects of a new synthetic compound that selectively blocks 11beta-HSD1 on the ability of mice to complete a memory task, called the Y maze. Professor Jonathan Seckl from the University of Edinburgh, who discovered the role of 11beta-HSD1 in the brain, described the findings: "Normal old mice often have marked deficits in learning and memory just like some elderly people. We found that life-long partial deficiency of 11beta-HSD1 prevented memory decline

with aging. But we were very surprised to find that the blocking compound works quickly over a few days to improve memory in old mice suggesting it might be a good treatment for the already elderly."

The effects were seen after only 10 days of treatment.

Professor Brian Walker and Dr Scott Webster from the University of Edinburgh are leading the drug development programme. Professor Walker added: "These results provide proof-of-concept that this class of drugs could be useful to treat age-related decline in memory. We previously showed that carbenoxolone, an old drug that blocks multiple enzymes including 11beta-HSD1, improves memory in healthy elderly men and in patients with type 2 diabetes after just a month of treatment, so we are optimistic that our new compounds will be effective in humans. The next step is to conduct further studies with our preclinical candidate to prove that the compound is safe to take into clinical trials, hopefully within a year."

The 11beta-HSD1 enzyme has also been implicated in metabolic diseases including diabetes and obesity by the Edinburgh team, and similar drugs that block its activity outside of the brain are already under investigation.

This study was supported by the Wellcome Trust and the Medical Research Council (MRC). The drug development programme in Edinburgh is supported by a Seeding Drug Discovery award from the Wellcome Trust.

Dr Rick Davis of the Wellcome Trust commented: "Developing drugs that can selectively inhibit this enzyme has been a challenge to the pharmaceutical industry for nearly 10 years. Advancing this compound towards clinical trials takes us a step closer to finding a drug that could have far reaching implications as the population ages."

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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#### Story Source:

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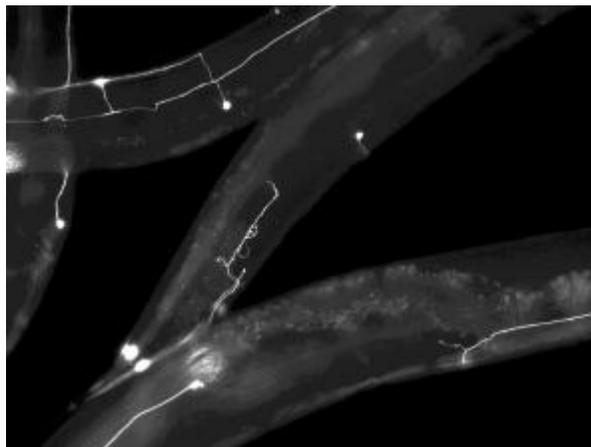
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## Microchip Technology Rapidly Identifies Compounds for Regrowing Nerves in Live Animals



MIT engineers have developed a way to rapidly perform surgery on single nerve cells in the worm *C. elegans*. The white lines represent axons — long extensions of nerve cells that carry messages to other cells. (Credit: Craig Millman and Yanik Lab)

ScienceDaily (Oct. 11, 2010) — Scientists have long sought the ability to regenerate nerve cells, or neurons, which could offer a new way to treat spinal-cord damage as well as neurological diseases such as Alzheimer's or Parkinson's. Many chemicals can regenerate neurons grown in Petri dishes in the lab, but it's difficult and time-consuming to identify those chemicals that work in live animals, which is critical for developing drugs for humans.

Engineers at MIT have now used a new microchip technology to rapidly test potential drugs on tiny worms called *C. elegans*, which are often used in studies of the nervous system. Using the new technology, associate professor Mehmet Fatih Yanik and his colleagues rapidly performed laser surgery, delivered drugs and imaged the resulting neuron regrowth in thousands of live animals.

"Our technology helps researchers rapidly identify promising chemicals that can then be tested in mammals and perhaps even in humans," says Yanik. Using this technique, the researchers have already identified one promising class of neuronal regenerators.

The paper will appear in the online edition of the *Proceedings of the National Academy of Sciences* the week of Oct. 11.

*C. elegans* is a useful model organism for neuron regeneration because it is optically transparent, and its entire neural network is known. Yanik and colleagues had previously developed a femtosecond laser nanosurgery technique which allowed them to cut and observe regeneration of individual axons -- long extensions of neurons that send signals to neighboring cells. Their femtosecond laser nanosurgery technique uses tightly-focused infrared laser pulses that are shorter than billionth of a second. This allows the laser to penetrate deep into the animals without damaging the tissues on its way, until the laser beam hits its very final target i.e. the axon.

In the PNAS study, the researchers used their microchip technology to rapidly cut the axons of single neurons that sense touch. Moving single worms from their incubation well to an imaging microchip, immobilizing them and performing laser surgery takes only about 20 seconds, which allows thousands of surgeries to be performed in a short period of time.

After laser surgery, each worm is returned to its incubation well and treated with a different chemical compound. *C. elegans* neurons can partially regrow without help, which allowed Yanik's team to look for drugs that can either enhance or inhibit this regrowth. After two or three days, the researchers imaged each worm to see if the drugs had any effect.

The MIT team found that a compound called staurosporine, which inhibits certain enzymes known as PKC kinases, had the strongest inhibitory effect. In a follow-up study, they tested some compounds that activate



these kinases, and found that one of them stimulated regeneration of neurons significantly. Some of Yanik's students are now testing those compounds on neurons derived from human embryonic stem cells.

This microchip technology can also be used to screen compounds for their effects on other diseases such as Alzheimer's, Parkinson's and ALS, says Yanik.

*Editor's Note: This article is not intended to provide medical advice, diagnosis or treatment.*

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Massachusetts Institute of Technology**.

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## Diabetes Gene Linked to Degeneration of Enzyme Involved in Alzheimer's Disease Onset and Progression

ScienceDaily (Oct. 13, 2010) — Mount Sinai School of Medicine researchers have found that a gene associated with the onset of Type 2 diabetes also is found at lower-than-normal levels in people with Alzheimer's disease. The research, led by Giulio Maria Pasinetti, MD, PhD, The Saunder Family Professor in Neurology, and Professor of Psychiatry and Geriatrics and Adult Development at Mount Sinai School of Medicine, was published this month in *Aging Cell*.

The new study provides insight into a potential mechanism that might explain the relationship between Type 2 diabetes and the onset and progression of Alzheimer's disease. Recent evidence indicates that healthy elderly subjects affected by Type 2 diabetes are twice as likely to develop Alzheimer's disease, but researchers have been unable to explain how.

"The relationship between Type 2 diabetes and Alzheimer's disease has been elusive," said Dr. Pasinetti.

"This new evidence is of extreme interest, especially since approximately 60 percent of Alzheimer's disease cases have at least one serious medical condition primarily associated with Type 2 diabetes."

Using mice that were genetically engineered to have Alzheimer's disease comparable to that seen in humans, Dr. Pasinetti and colleagues found that a gene known as proliferator-activated receptor coactivator 1 (PGC-1), a key regulator of glucose currently investigated as a potential therapeutic target for Type 2 diabetes, is decreased in Alzheimer's disease. The team reports that this decrease might be causally linked to promotion of Alzheimer's disease. They found that PGC-1 promotes degradation of a specific enzyme known as beta-secretase (BACE). ACE is directly involved in the processing and eventually generation of  $\beta$ -amyloid, an abnormal protein highly linked to Alzheimer's disease and brain degeneration.

"Our research is the first to find that PGC-1 is a common denominator between Type 2 diabetes and Alzheimer's disease," said Dr. Pasinetti. "This discovery will have significant implications for the more than five million Americans affected by Alzheimer's disease, a number that is expected to skyrocket in the next three decades as the population ages. We look forward to continuing to research this discovery and translate it into the development of novel approaches for disease prevention and treatment."

Dr. Pasinetti and his colleagues are optimistic that if they find that PGC-1 can be manipulated pharmacologically to prevent BACE accumulation in the brain, these studies will provide important insights for the formulation of novel treatments and possible preventative strategies in Alzheimer's disease.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **The Mount Sinai Hospital / Mount Sinai School of Medicine**.

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## Striding Towards a New Dawn for Electronics

ScienceDaily (Oct. 13, 2010) — Conductive polymers are plastic materials with high electrical conductivity that promise to revolutionize a wide range of products including TV displays, solar cells, and biomedical sensors. A team of McGill University researchers now reports how to visualize and study the process of energy transport along one single conductive polymer molecule at a time, a key step towards bringing these exciting new applications to market.

"We may easily study energy transport in a cable as thick as a hair, but imagine studying this process in a single polymer molecule, whose thickness is one-millionth of that!" said Dr. Gonzalo Cosa of McGill's Department of Chemistry, lead researcher.

Working in collaboration with Dr. Isabelle Rouiller of McGill's Department of Anatomy and Cell Biology, the team used state-of-the-art optical and electron microscopes and were able to entrap the polymer molecules into vesicles -- tiny sacs smaller than a human body cell. The researchers visualized their ability to transport energy in various conformations.

"This research is novel because we are able to look at energy transport in individual polymer molecules rather than obtaining measurements arising from a collection of billions of them. It's like looking at the characteristics of a single person rather than having to rely on census data for the entire world population," Cosa explains. Conductive polymers are long organic molecules typically referred to as nanowires. Components along the polymer backbone successfully pass energy between each other when the polymer is collapsed (coiled within itself), but the process is slowed down when the polymer backbone is extended. A greater understanding of how this process works will enable us to develop a range of technologies in the future."

The studies are critical to applications in daily life such as sensors involving the detection and the differentiation of cells, pathogens, and toxins. They may also help in the future to develop hybrid organic-inorganic light harvesting materials for solar cells.

The research was published online by the *Proceedings of the National Academy of Sciences* and received funding from the Natural Sciences and Engineering Research Council and the Canada Foundation for Innovation.

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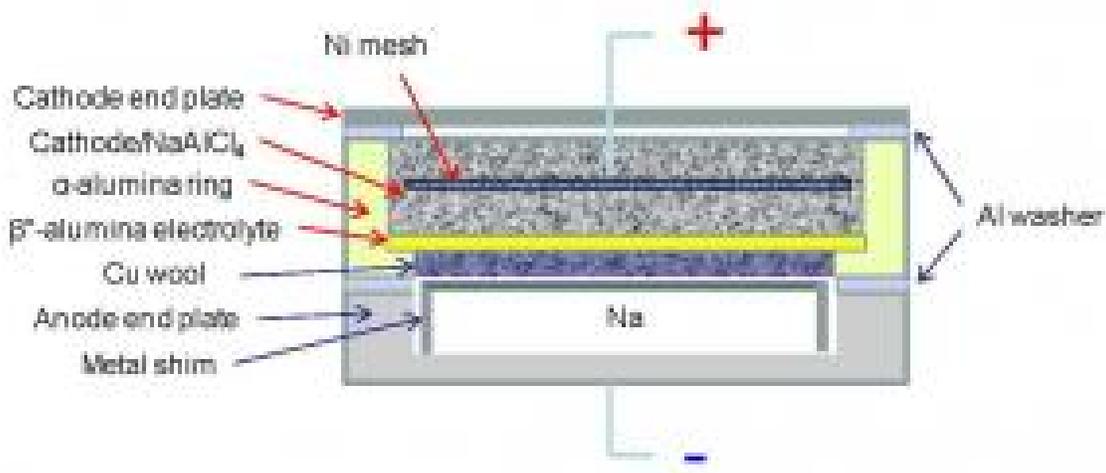
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## Planar Power: Flat Sodium-Nickel Chloride Battery Could Improve Performance, Cost of Energy Storage



*A flat or planar sodium-nickel chloride battery could deliver 30 percent more power at lower temperatures than its cylindrical counterpart, making it a viable alternative to lithium-ion batteries for storing wind and solar power on the electric grid. (Credit: Image courtesy of Pacific Northwest National Laboratory)*

ScienceDaily (Oct. 13, 2010) — A redesign of sodium-nickel chloride batteries promises to overcome some of the obstacles long associated with rechargeable batteries. Replacing their typical cylindrical shape with a flat disc design allows the battery to deliver 30 percent more power at lower temperatures, according to work published by the Department of Energy's Pacific Northwest National Laboratory in the October 8 issue of *ECS Transactions*, a trade journal.

Researchers say these sodium-beta batteries could eventually be used in electricity substations to balance the generation and delivery of wind and solar power on to the grid.

Because the battery's main components include abundant materials such as alumina, sodium chloride and nickel, they are less expensive to manufacture than lithium-ion batteries, and could still offer the performance necessary to compete for consumers' interest. In addition, compared to other battery systems, sodium-beta batteries are safer and can help incorporate renewable energy sources into the electrical system easier.

"This planar sodium battery technology shows potential as an option for integrating more solar and wind power into our electric grid," said Carl Imhoff, electricity infrastructure sector manager at PNNL.

Sodium-beta alumina batteries have been around since the 1960s but their tubular, cylindrical shape does not allow efficient discharge of stored electrochemical energy. This inefficiency causes technical issues associated with operating at high temperatures and raises concern about the cost-effectiveness of the tubular batteries.

Lithium-ion batteries surpassed sodium-beta batteries because they perform better. However, materials for lithium batteries are limited, making them more expensive to produce. Safety also has been a concern for rechargeable lithium batteries because they can be prone to thermal runaway, a condition where the battery continually heats up until it catches fire.

"The PNNL planar battery's flat and thin design has many advantages over traditional, tubular sodium nickel chloride batteries," said PNNL Scientist Xiaochuan Lu, co-author of the paper.

To take advantage of inexpensive materials, the PNNL researchers thought a redesign of the sodium-beta batteries might overcome the technical and cost issues: the cylindrical sodium beta batteries contain a thick, solid electrolyte and cathode that create considerable resistance when the sodium ion travels back and forth between the anode and the cathode while the battery is in use. This resistance reduces the amount of power

produced. To lower the resistance, temperature must be elevated. But increasing operation temperature will shorten the battery's lifespan.

The researchers then tested the performance of their redesigned sodium-nickel chloride planar batteries, which look like wafers or large buttons.

The researchers found that a planar design allows for a thinner cathode and a larger surface area for a given cell volume. Because the ions can flow in a larger area and shorter pathway, they experience lower resistance. Next, the battery's design incorporates a thin layer of solid electrolytes, which also lowers the resistance. Because of the decrease of resistance, the battery can afford to be operated at a lower temperature while maintaining a power output 30% more than a similar-sized battery with a cylindrical design.

Finally, the battery's flat components can easily be stacked in a way that produces a much more compact battery, making it an attractive option for large-scale energy storage, such as on the electrical grid.

"Our goal is to get a safer, more affordable battery into the market for energy storage. This development in battery technology gets us one step closer," said Lu.

Researchers at PNNL and EaglePicher LLC received funding from the Advanced Research Projects Agency - Energy, or ARPA-E, earlier this year to conduct the research, and will work together to improve the battery's design, lifespan and power capacity.

The research was funded by PNNL and by ARPA-E.

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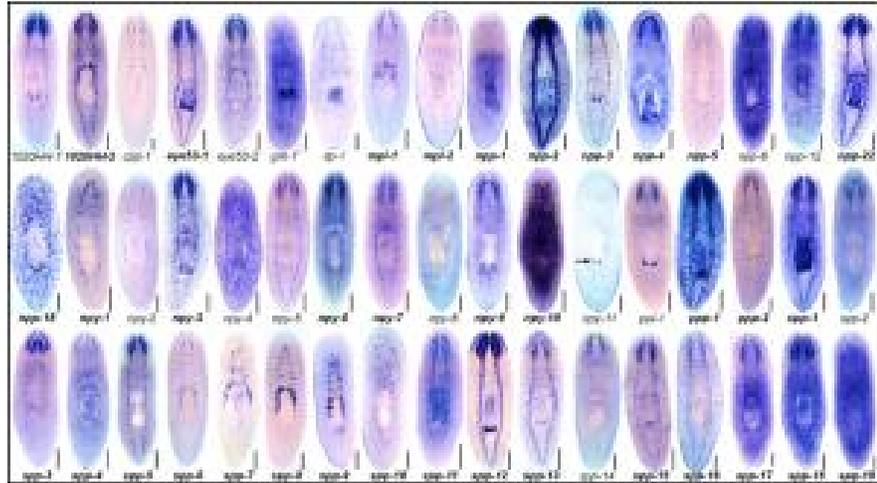
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## Study of Planarian Hormones May Aid in Understanding Parasitic Flatworms



The researchers traced expression of 51 prohormone genes in different tissues throughout the planarian body. One of these genes, known as *npy-8*, appears to promote the development and maintenance of the worm's reproductive organs. (Credit: Image courtesy of Jim Collins)

ScienceDaily (Oct. 13, 2010) — A study of peptide hormones in the brain of a seemingly primitive flatworm reveals the surprising complexity of its nervous system and opens up a new approach for combating a major parasitic disease, researchers report.

The study appears in the open-access journal *PLoS Biology*.

The planarian flatworm, *Schmidtea mediterranea*, is perhaps best known for its prodigious powers of regeneration. Cut it in half (lengthwise or crosswise) and each fragment will regrow its missing parts, including its brain. The planarian is of interest to those studying reproduction because it exists in sexual and asexual varieties. Asexual planaria reproduce by splitting into two pieces and then regenerating. Sexual planaria are hermaphroditic. Some planaria can even switch between the sexual and asexual forms.

The free-living planarian is also of interest because it is related to several parasitic flatworms. For example, flatworms of the genus *Schistosoma* parasitize more than 200 million people worldwide. Schistosome larvae can penetrate the skin and spread when a potential host comes into contact with contaminated water. Once inside a host, the worms mature, mate and produce thousands of eggs that damage internal organs.

"Schistosomiasis is one of the major neglected tropical diseases in the world," said University of Illinois cell and developmental biology professor and Howard Hughes Medical Institute investigator Phillip Newmark, who led the new study with post-doctoral fellow James Collins. "And a key to the pathology of the disease is the animal's amazing reproductive output."

Previous studies suggested that signals from the nervous system play a role in planarian reproduction, but little research had been done to clarify that role.

"We've known for decades that neuropeptides are important for coordinating vertebrate reproduction," Collins said. "But it's not clear whether similar sorts of mechanisms exist for controlling invertebrate reproductive development."

Collins began by disrupting neuropeptide processing in sexually reproducing planaria, and noticed that this caused the animals' reproductive organs to revert to a developmentally primitive stage. This was strong evidence that neuropeptides could influence sexual development in planaria.

Neuropeptides are processed from longer molecules, called prohormones, and often are chemically modified before they become biologically active. Because neuropeptides are made up of only a few (typically between 3 and 40) amino acids, identifying the genes that code for them is a challenging task.

Collins worked with Illinois chemistry professor Jonathan Sweedler, as well as graduate student Xiaowen Hou and post-doctoral associate Elena Romanova, on the painstaking process of identifying prohormone

genes in planaria. Using bioinformatics coupled with mass spectroscopy, the researchers identified 51 genes predicted to encode more than 200 peptides. Sweedler's lab worked out the biochemical properties of 142 of these using mass spectroscopy.

Collins then traced expression of 51 prohormone genes in different tissues throughout the planarian body. This analysis showed a unique pattern of expression for each gene (see image), with some expressed only in specific cells in the brain and other tissues.

"These peptides are showing us that the planarian brain is much more complicated than we had appreciated," Newmark said. "The fact that they can regenerate this brain seems even more amazing now that we know this."

To understand the potential function of the peptides, Collins used RNA interference to block the activity of specific prohormone genes in sexual and asexual planaria.

"We showed that there were different signatures in peptide hormone expression in asexual planarians that reproduce by fissioning, by tearing themselves in half, and by sexually reproducing planarians that are hermaphrodites and mate and lay eggs," Newmark said.

This comparison led to the discovery that one neuropeptide, in particular, profoundly influences the development and maintenance of the animal's reproductive system. When the researchers blocked expression of this neuropeptide, called npy-8, in mature sexual planaria, the worms' testes and other reproductive organs regressed. Blocking npy-8 in juvenile sexual planaria prevented their sexual organs from properly developing. This last finding may point to a new approach for fighting parasitic flatworm infections, the researchers said. Thwarting the reproductive capabilities of a schistosome, for example, would likely be a very effective treatment.

"The planarian is a relatively innocuous animal that has relevance to a huge human health issue," Sweedler said.

The study also supports the use of planaria as a model organism, the researchers said. Its ability to regenerate, the ease with which it is grown in the lab, and the fact that it exists in sexual and asexual forms always has been of interest, Newmark said. But the newly appreciated complexity of its brain and the fact that it makes use of many of the signaling molecules that are essential in vertebrates also enhances its usefulness to science. The National Institutes of Health and the National Science Foundation supported this research.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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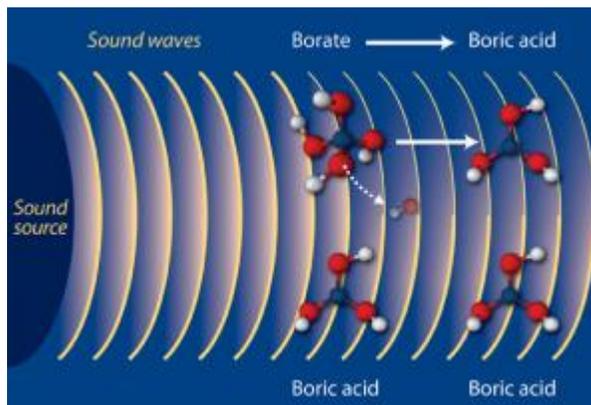
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## Ocean Acidification Poses Little Threat to Whales' Hearing, Study Suggests



Low-frequency sound waves in the ocean cause borate to lose an -OH group and become boric acid (top). In the process, the sound waves lose energy. An identical sound wave has no effect on boric acid (bottom). More-acidic conditions reduce the amount of borate in seawater, which led some researchers to suggest that ocean acidification will lead to less absorption of sound energy, allowing sound waves to travel farther in the ocean than they do at present. WHOI scientists showed that the effect will be minimal. (Credit: Illustration by Jack Cook, Woods Hole Oceanographic Institution)

ScienceDaily (Oct. 13, 2010) — Contrary to some previous, highly publicized, reports, ocean acidification is not likely to worsen the hearing of whales and other animals, according to a Woods Hole Oceanographic Institution (WHOI) scientist who studies sound propagation in the ocean.

Tim Duda, of WHOI's Applied Ocean Physics & Engineering Department, undertook a study in response to warnings that as the ocean becomes more acidic -- due to elevated levels of atmospheric carbon dioxide (CO<sub>2</sub>)--noise from ships will be able to travel farther and possibly interfere with whales and other animals that rely on sound to navigate, communicate, and hunt.

Duda and WHOI scientists Ilya Udovydchenkov, Scott Doney, and Ivan Lima, along with colleagues at the Naval Postgraduate School, designed mathematical models of sound propagation in the oceans. Their models found that the increase would be, at most, 2 decibels by the year 2100 -- a negligible change compared with noise from natural events such as storms and large waves. Noise levels are predicted to change even less than this in higher-noise areas near sources such as shipping lanes, Duda said.

Their work is published in the September 2010 issue of the *Journal of the Acoustical Society of America*.

### Story Source:

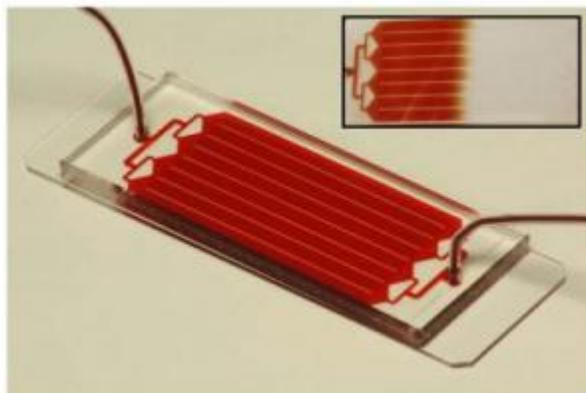
The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Woods Hole Oceanographic Institution**.

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1. Ilya A. Udovydchenkov, Timothy F. Duda, Scott C. Doney, and Ivan D. Lima. **Modeling deep ocean shipping noise in varying acidity conditions**. *J. Acoust. Soc. Am.*, 128 EL130 (2010) [[link](#)]

<http://www.sciencedaily.com/releases/2010/10/101011215015.htm>

## Second-Generation Device More Effective in Capturing Circulating Tumor Cells



*The herringbone pattern of interior surfaces in the HB-Chip brings more circulating tumor cells into contact with the antibody-coated capture surfaces. The inset shows the uniform blood flow through the device.*

*(Credit: Proceedings of the National Academy of Sciences)*

ScienceDaily (Oct. 13, 2010) — A redesigned version of the CTC-Chip -- a microchip-based device for capturing rare circulating tumor cells (CTCs) -- appears to be more effective and should be easier to manufacture than the original. Called the HB-(herringbone) Chip, the new device also may provide more comprehensive and easily accessible data from captured tumor cells. Massachusetts General Hospital (MGH) researchers -- including members of the team that developed the CTC-Chip -- report the second-generation device in a *Proceedings of the National Academy of Sciences* paper that has been released online.

"The originally CTC-Chip worked wonderfully in a small-scale laboratory setting, but limitations arose when we attempted to increase production for larger clinical studies. The new device performs as well or better than the previous technology with several additional benefits," says Shannon Stott, PhD, of the MGH Center for Engineering in Medicine, co-lead author of the *PNAS* paper. "It also was able to capture something that had never been seen using either the CTC-chip or the most prevalent previous technology -- small clusters of CTCs, the significance of which we need to study."

CTCs are living solid tumor cells found at extremely low levels in the bloodstream. Until the 2007 development of the CTC-chip by researchers from the MGH Cancer Center and the Center for Engineering in Medicine, it was not possible to get information from CTCs that would be useful for clinical decision making. In the original device, patient blood samples are passed over a silicon chip covered with microscopic posts coated with an antibody that binds to most tumor cells. Not only did this design proved challenging to manufacture reliably and cost-effectively, but the smooth flow of blood around the microposts also limited the number of CTCs that came into contact with the antibody-covered surfaces. In their search to increase the capture of CTCs, the researchers found that passing samples through a chamber lined with a herringbone pattern of grooves -- an approach developed elsewhere for quickly mixing independent streams of fluid -- would generate a more chaotic flow that could significantly increase the number of captured cells.

The HB-Chip also can process larger-volume blood samples, increasing the ability to find rare CTCs. The microchip is mounted on a standard glass slide, which allows the use of standard pathology tests to identify cancer cells; and the device can be easily opened, giving access to CTCs for additional testing and growth in culture. Experiments comparing the HB-Chip to the CTC-chip found the new device captured more than 90 percent of cancer cells introduced into blood samples -- a 25 percent improvement over the CTC-chip. Tests of samples from cancer patients found the redesigned device at least as effective as the original.

The HB-Chip also captured clusters of 4 to 12 CTCs from several patient samples but not from samples to which cancer cells had been added. No previous technology for capturing CTCs has ever found such clumps of tumor cells. "These clusters may have broken off from the original tumor, or they might represent proliferation of CTCs within the circulation," says Mehmet Toner, PhD, director of the



BioMicroElectroMechanical Systems Resource Center in the MGH Center for Engineering in Medicine, the paper's senior author. "Further study of these clusters could provide valuable insight in the metastatic process."

Daniel Haber MD PhD, director of the MGH Cancer Center and a co-author of the study, says, "This new technology is a powerful platform that will enable increasingly sophisticated analyses of metastasis and support clinical research in targeted cancer therapies."

While the MGH has filed a patent for the HB-Chip, the research team will continue to develop the technology before potential licensing is explored. The study was supported by grants from Stand Up to Cancer, the Prostate Cancer Foundation, the National Institute for Biomedical Imaging and Bioengineering, the National Cancer Institute and the American Cancer Society, along with several additional funders.

*Editor's Note: This article is not intended to provide medical advice, diagnosis or treatment.*

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Massachusetts General Hospital**, via **EurekAlert!**, a service of AAAS.

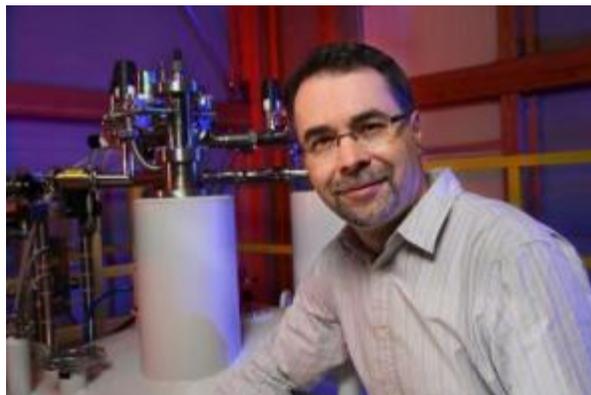
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1. S. L. Stott, C.-H. Hsu, D. I. Tsukrov, M. Yu, D. T. Miyamoto, B. A. Waltman, S. M. Rothenberg, A. M. Shah, M. E. Smas, G. K. Korir, F. P. Floyd, A. J. Gilman, J. B. Lord, D. Winokur, S. Springer, D. Irimia, S. Nagrath, L. V. Sequist, R. J. Lee, K. J. Isselbacher, S. Maheswaran, D. A. Haber, M. Toner. **Isolation of circulating tumor cells using a microvortex-generating herringbone-chip**. *Proceedings of the National Academy of Sciences*, 2010; DOI: [10.1073/pnas.1012539107](https://doi.org/10.1073/pnas.1012539107)

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## Better Way to Study Proteins in the Body: Could Streamline Development of Drugs



*This is Rafael Brüschweiler of Florida State University. (Credit: FSU Photo Lab)*

ScienceDaily (Oct. 13, 2010) — Using a combination of high-powered computers and advanced experimental magnetic resonance data, a Florida State University biophysical chemist has developed techniques that improve the way scientists can study and predict the structure and dynamics of proteins found in the human body. His innovations could ultimately shorten the time it takes researchers to develop new, more effective drugs and better understand biomedical processes that underlie a variety of health conditions.

The new techniques "allow us to more accurately understand protein behavior and function at all levels, how enzymes work, and how to develop drugs that bind to certain proteins," said Rafael Brüschweiler, the George Mathew Edgar Professor in Florida State's Department of Chemistry and Biochemistry and associate director for biophysics at the National High Magnetic Field Laboratory.

Given that there are hundreds of thousands of different proteins found in the human body, innovations such as Brüschweiler's that can streamline their analysis and understanding are viewed as most desirable in the scientific community.

Over the past several years, Brüschweiler and his colleagues have integrated a pair of complementary but powerful tools, both of which provide detailed information about the structure and dynamics of proteins at the atomic level. Nuclear magnetic resonance (NMR) data are first collected for a particular protein that is being analyzed. (NMR is a research tool that utilizes high magnetic fields to measure the strengths, directions and temporary fluctuations of magnetic interactions between the atoms in a protein fragment.)

Next, in a technique Brüschweiler has pioneered, high-powered computers are used to validate the NMR data in terms of their realistic representation of protein structure and dynamics, as well as to make additional predictions of those characteristics.

The computational results critically rely on the shape of the protein's "energy landscape" -- the conformational space available to that protein under physiological conditions. However, due to its complexity, improving characterizations of the energy landscape is a difficult and time-consuming undertaking. In fact, until recently, a computer simulation of a single protein that represented just a microsecond took several months. Now, with the aid of the powerful computer array at Florida State's High Performance Computing Center, it takes Brüschweiler and his group only a fraction of the time it once did.

Working with a postdoctoral associate, Da-Wei Li, Brüschweiler has found a highly efficient way to directly use the NMR information for improving the protein potential. The basic idea is to "recycle" an existing simulation of an intact protein, using methods borrowed from statistical physics, for many trial potentials until the one is found that yields the best agreement with experiment. This leads to an increase in speed by a factor of 100,000 or more over previous methods. The approach is not only efficient but also permits the improvement of the protein potential directly on intact proteins, rather than on small fragments, as was the case in the past.

"This has opened up a new way of becoming increasingly quantitative in our computations, which is key in developing a predictive understanding of the functions of proteins," Brüschweiler said.



"As computers continue to become ever more powerful, 'in silico' approaches to the understanding of proteins will play an increasingly important role. However, these approaches need to be calibrated first against quantitative experimental data, which makes the combination with NMR so powerful."

A paper describing the research was recently published in the German publication *Angewandte Chemie* (Applied Chemistry).

"This is the culmination of a number of years of research on our part, so obviously we're excited about the progress we have made," Brüscheiler said. "While this is fairly basic research designed to develop a greater understanding of life at a molecular level, it opens up a range of possibilities for future advances by scientists all over the world."

"For example, it might be possible to develop and refine new drugs that target specific proteins in a certain way," he said. "Or to design new proteins that act as 'molecular machines' to perform specific functions in response to chemical stimuli."

Brüscheiler is currently in the second year of a four-year, \$608,782 grant from the National Science Foundation that is helping to fund his research.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Florida State University**. The original article was written by Barry Ray.

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**Journal Reference:**

1. Da-Wei Li, Rafael Brüscheiler. **NMR-Based Protein Potentials**. *Angewandte Chemie International Edition*, 2010; 49 (38): 6778 DOI: [10.1002/anie.201001898](https://doi.org/10.1002/anie.201001898)

<http://www.sciencedaily.com/releases/2010/10/101012101621.htm>



## Watermelon Lowers Blood Pressure, Study Finds



*New research suggests that watermelon can be an effective natural weapon against prehypertension, a precursor to cardiovascular disease. (Credit: iStockphoto/Serhiy Shullye)*

ScienceDaily (Oct. 13, 2010) — No matter how you slice it, watermelon has a lot going for it -- sweet, low calorie, high fiber, nutrient rich -- and now, there's more. Evidence from a pilot study led by food scientists at The Florida State University suggests that watermelon can be an effective natural weapon against prehypertension, a precursor to cardiovascular disease.

It is the first investigation of its kind in humans. FSU Assistant Professor Arturo Figueroa and Professor Bahram H. Arjmandi found that when six grams of the amino acid L-citrulline/L-arginine from watermelon extract was administered daily for six weeks, there was improved arterial function and consequently lowered aortic blood pressure in all nine of their prehypertensive subjects (four men and five postmenopausal women, ages 51-57).

"We are the first to document improved aortic hemodynamics in prehypertensive but otherwise healthy middle-aged men and women receiving therapeutic doses of watermelon," Figueroa said. "These findings suggest that this 'functional food' has a vasodilatory effect, and one that may prevent prehypertension from progressing to full-blown hypertension, a major risk factor for heart attacks and strokes.

"Given the encouraging evidence generated by this preliminary study, we hope to continue the research and include a much larger group of participants in the next round," he said.

Why watermelon?

"Watermelon is the richest edible natural source of L-citrulline, which is closely related to L-arginine, the amino acid required for the formation of nitric oxide essential to the regulation of vascular tone and healthy blood pressure," Figueroa said.

Once in the body, the L-citrulline is converted into L-arginine. Simply consuming L-arginine as a dietary supplement isn't an option for many hypertensive adults, said Figueroa, because it can cause nausea, gastrointestinal tract discomfort, and diarrhea.

In contrast, watermelon is well tolerated. Participants in the Florida State pilot study reported no adverse effects. And, in addition to the vascular benefits of citrulline, watermelon provides abundant vitamin A, B6, C, fiber, potassium and lycopene, a powerful antioxidant. Watermelon may even help to reduce serum glucose levels, according to Arjmandi.

"Cardiovascular disease (CVD) continues to be the leading cause of death in the United States," Arjmandi said. "Generally, Americans have been more concerned about their blood cholesterol levels and dietary cholesterol intakes rather than their overall cardiovascular health risk factors leading to CVD, such as obesity and vascular dysfunction characterized by arterial stiffening and thickness -- issues that functional foods such as watermelon can help to mitigate.

"By functional foods," said Arjmandi, "we mean those foods scientifically shown to have health-promoting or disease-preventing properties, above and beyond the other intrinsically healthy nutrients they also supply." Figueroa said oral L-citrulline supplementation might allow a reduced dosage of antihypertensive drugs necessary to control blood pressure.

"Even better, it may prevent the progression from prehypertension to hypertension in the first place," he said. While watermelon or watermelon extract is the best natural source for L-citrulline, it is also available in the synthetic form in pills, which Figueroa used in a previous study of younger, male subjects. That investigation showed that four weeks of L-citrulline slowed or weakened the increase in aortic blood pressure in response to cold exposure. It was an important finding, said Figueroa, since there is a greater occurrence of myocardial infarction associated with hypertension during the cold winter months.

"Individuals with increased blood pressure and arterial stiffness -- especially those who are older and those with chronic diseases such as type 2 diabetes -- would benefit from L-citrulline in either the synthetic or natural (watermelon) form," Figueroa said. "The optimal dose appears to be four to six grams a day." Approximately 60 percent of U.S. adults are prehypertensive or hypertensive. Prehypertension is characterized by systolic blood pressure readings of 120-139 millimeters of mercury (mm Hg) over diastolic pressure of 80-89 mm Hg. "Systolic" refers to the blood pressure when the heart is contracting. "Diastolic" reflects the blood pressure when the heart is in a period of relaxation and expansion.

Findings from Figueroa's latest pilot study at Florida State are described in the *American Journal of Hypertension*. A copy of the paper ("Effects of Watermelon Supplementation on Aortic Blood Pressure and Wave Reflection in Individuals With Prehypertension: A Pilot Study") can be accessed online.

The paper's lead author, Figueroa holds a medical degree, a doctoral degree in physiological sciences, and a master's degree in sports medicine. He has been a faculty member in the Florida State University Department of Nutrition, Food and Exercise Sciences since 2004. Figueroa's coauthor and colleague Arjmandi serves as chairman of the department, which is a part of Florida State's interdisciplinary College of Human Sciences. Arjmandi also is the author or coauthor of an extensive body of published research on the health benefits of prunes and other functional foods.

Coauthors of the Figueroa-Arjmandi paper in the *American Journal of Hypertension* are Marcos A. Sanchez-Gonzalez, a Florida State doctoral student in exercise physiology, and Penelope Perkins-Veazie, a horticulture professor at North Carolina State University.

**Editor's Note:** This article is not intended to provide medical advice, diagnosis or treatment.

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#### Story Source:

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Florida State University**, via [EurekAlert!](#), a service of AAAS.

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#### Journal Reference:

1. Arturo Figueroa, Marcos A. Sanchez-Gonzalez, Penelope M. Perkins-Veazie, Bahram H. Arjmandi. **Effects of Watermelon Supplementation on Aortic Blood Pressure and Wave Reflection in Individuals With Prehypertension: A Pilot Study.** *American Journal of Hypertension*, 2010; DOI: [10.1038/ajh.2010.142](https://doi.org/10.1038/ajh.2010.142)

<http://www.sciencedaily.com/releases/2010/10/101013173847.htm>

## From Taft to Obama, Victrola to DVD: Secrets of the Centenarians

By KAREN BARROW



Alex di Suvero for The New York Times

Rose Katz, 103, of Riverdale came to the United States from Czechoslovakia as a 20-year old and worked in New York making men's neckties. She is fluent in English, Czech, Hungarian, Slovak and Yiddish.

Centenarians alive today are older than the Titanic, crossword puzzles and Mickey Mouse. They have lived through 19 presidencies and two world wars. They saw the rise of motion pictures and radio, followed by the invention of television.

Some traveled here long ago as immigrants; others have spent their entire lives in one small town. They have celebrated golden anniversaries and beyond, and witnessed the birth of great-grandchildren and great-great-grandchildren.

Many of them are still happy to be driving, dancing, walking or simply breathing. But others are clinging to their remaining abilities and wondering if they are too much of a burden to their loved ones.

Not surprisingly, the question they hear most often is "What is the secret to a long life?"

**ESTHER TUTTLE, 99** "I think the secret of a long life is partly genes, but I also think it's being conscious of your body. Your body is your instrument. So I always did exercises, did a lot of yoga, stretching exercises and walking. Eat in moderation and drink in moderation. Because everybody smoked, I kind of had to smoke in self-defense. But moderation is a wonderful thing."

**HAZEL MILLER, 100** "There's no secret about it, really. You just don't die, and you get to be 100.

"I have always liked to dance. But as you know, after a certain age, there are no men to dance with. So I started line dancing, and I belong to a group called the Silver Belles, and we made costumes, and we danced and did public service engagements.



“I don’t need help with anything. I just pass the time reading, painting, going. I have a lot of friends I visit with. I eat out two or three times a week. So the time passes. In fact, I flit around doing a lot of things when I should be painting.

“The best part of being 100 is you live to be 100. If you can enjoy it, that is an extra good thing.”

**PHIL DAMSKY, 100** “We go out to lunch every once in a while. So we went to a place called Hooters, and there were eight or nine of us. Somebody told the manager that I was 100 years old. So the manager said that they’d pay for the meal — we didn’t have to pay for the meals. Then we took pictures with the waitresses. I thought it was very nice of them.

“My appetite was always good. You know, food is food. I like a corned beef sandwich, corned beef or pastrami. But then I have to watch myself because some of these things have too much salt.

“I thought I was going to live forever, but there’s no such thing. But enjoy every minute that you’re living. I think that’s some good advice.”

**ROSE KATZ, 103** “I don’t know what a cold is. I was always a healthy person — a healthy, strong person. I suppose that’s what keeps me alive.”

[http://www.nytimes.com/2010/10/19/health/19Voices1.html?\\_r=1&nl=health&emc=healthupdateema2](http://www.nytimes.com/2010/10/19/health/19Voices1.html?_r=1&nl=health&emc=healthupdateema2)



## The empathy deficit

### Even as they become more connected, young people are caring less about others

By Keith O'Brien | October 17, 2010



(Globe Staff photo illustration )

Young Americans today live in a world of endless connections and up-to-the-minute information on one another, constantly updating friends, loved ones, and total strangers — “Quiz tomorrow...gotta study!” — about the minutiae of their young, wired lives. And there are signs that Generation Wi-Fi is also interested in connecting with people, like, face-to-face, in person. The percentage of high school seniors who volunteer has been rising for two decades.

But new research suggests that behind all this communication and connectedness, something is missing. The study, conducted by researchers at the University of Michigan Institute for Social Research, found that college students today are 40 percent less empathetic than they were in 1979, with the steepest decline coming in the last 10 years.

According to the findings, today’s students are generally less likely to describe themselves as “soft-hearted” or to have “tender, concerned feelings” for others. They are more likely, meanwhile, to admit that “other people’s misfortunes” usually don’t disturb them. In other words, they might be constantly aware of their friends’ whereabouts, but all that connectedness doesn’t seem to be translating to genuine concern for the world and one another.

“To me, that’s the basic glue,” said Sara Konrath, a research assistant professor and the lead author of the study on empathy. “It’s so rewarding to connect with human beings. It’s so good for our bodies to do this. Everything we know as psychologists tells us it’s the most wonderful thing. So if we’re losing that, I think that is distressing.”

Empathy might seem like a hard-to-define, touchy-feely idea, and it’s fair to say that most of us don’t spend our days wondering if we’re empathetic. Yet psychologists have been trying to measure empathy for decades, recognizing its inherent value to humanity. A world without empathy, they say, is a world we wouldn’t want to live in.

“Do a thought experiment,” said Mark Davis, a professor of psychology at Eckerd College in Florida who’s spent the last 30 years studying empathy. “Imagine if humans didn’t have the capacity for empathy. What

would it mean if, in fact, we never gave a damn about what happened to other people? That's an almost an inconceivable world."

It's so inconceivable that Davis counts himself among the skeptics of the new research that documents the decline. "Put me down," he said, "as intrigued by it." He points out that Konrath, along with coauthors Edward O'Brien and Courtney Hsing, are drawing their conclusions from a relatively small sample size — just 72 studies over three decades. He and others would like to see more work on the matter before making any final conclusions about how much young people care, or don't care, about others. But even some skeptics agree that it's disturbing to consider the trend laid out in the new research and then play out the string.

"As awful a species as we can be — and we certainly have the capacity for terrible things — we're also capable of some pretty wonderful things, noble things, self-sacrifice," said Davis. "And the fear would be, if there really is a genuine decline in our ability to act on this capacity we have, the world becomes meaner."

Empathy is such a basic ingredient of the human experience that even babies exhibit it, crying when other children cry or reacting to the facial expressions of adults and parents. Yet the word itself is relatively new: It didn't enter the English lexicon until the early 1900s, derived from the German word *einfihlung*, according to Daniel Batson, a researcher of empathy and professor emeritus at Kansas University. And psychologists studying empathy still disagree on some basic questions about how it should be defined: Is it feeling for others? Feeling as others feel? Understanding how others feel? Or some combination of the above?

"It's all over the place," Batson said. "There's no agreed-upon definition."

But at the most basic level, most concur that empathy is some sort of emotional response to another person's plight, pain, state, or suffering. "It's not just putting oneself in another's shoes," said Aaron L. Pincus, a professor of psychology at Penn State University. "It's truly grasping what they're experiencing.... Your emotional state will move in a direction more similar to the person you're empathizing with."

In small ways, psychologists say, empathy is constantly driving our daily lives, as we take into consideration how other people might feel before we act. Some suggest that empathy is the foundation for social norms, even basic etiquette. We typically don't insult people to their faces, Davis explained, in part because we know they're not going to like how that feels.

Given its obvious importance to relationships and the human experience, psychologists began studying the issue in the early to mid-20th century. Some researchers have conducted live experiments, staging scenes where someone is suffering and then gauging how observers respond to watching the pain. Others, meanwhile, have developed surveys where people are asked to self-report how they feel, or don't feel, about others or themselves in certain situations. The survey respondents usually then receive a score, essentially assigning a number to describe just how empathetic they are or aren't.

Such studies have obvious flaws. Some people, when surveyed, want to give answers that reflect positively on them. However, researchers have found that these scales are actually effective at predicting how people will behave. Spouses who score higher on empathic concern are more likely to offer emotional support to their partners. People capable of seeing another person's perspective are more likely to help and less likely to exhibit aggression. And those who are narcissistic are probably going to be less empathetic. "Generally speaking," said Pincus, "there's a lack of empathy as narcissism increases."

That link between empathy and narcissism drove the Michigan study. In recent years, some psychologists, including Konrath, have offered evidence that narcissism may be on the rise, leading to a debate about whether that's actually happening and, if so, whether it's a problem. A certain amount of narcissism is healthy, psychologists point out, helping give people the confidence to compete, succeed, or lead others. But it can also tip the other way, creating a world of increased self-absorption. Konrath and her coauthors, hoping to get to the bottom of this debate, set out to measure how empathy had changed over time. If narcissism was truly on the rise, they postulated, then empathy had to be in decline. They began to analyze the results of 72 different surveys, given to almost 14,000 college students, beginning in 1979, charting how the students answered the same questions over time.

Initially, they found little shift. "It's looking sort of flat, or no real pattern, up until 2000," Konrath said. "And then there's this sudden, sharp drop."

Starting around a decade ago, scores in two key areas of empathy begin to tumble downward. According to the analysis, perspective-taking, often known as cognitive empathy — that is, the ability to think about how

someone else might feel — is declining. But even more troubling, Konrath noted, is the drop-off the researchers have charted in empathic concern, often known as emotional empathy. This is the ability to exhibit an emotional response to someone's else's distress.

Perhaps more than any other characteristic, one's capacity for empathic concern dictates how much one cares about others. Those who score high in empathic concern, according to past research, are more likely to return incorrect change to a cashier, let someone else ahead of them in line, carry a stranger's belongings, give money to a homeless person, volunteer, donate to a charity, look after a friend's pet or plant, or even live on a vegetarian diet. And what's alarming, Konrath said, is that empathic concern has fallen more than any other aspect of empathy. Between 1979 and 2009, according to the new research, empathic concern dropped 48 percent.

The results have led to the obvious follow-up questions: What cultural changes may have shaped children in the 1980s and '90s, giving rise to a less empathetic generation? Why do we care less? And is there any way we can reverse the trend?

The answers, to date, are all speculative. What's clear, Konrath said, is that something critical began happening about a decade ago when a new crop of college students began taking these standard surveys. These students, Konrath points out, would have been born in the 1980s, raised in the '90s on video games, 24-hour cable television, and widespread divorce, and sent off to college with laptops and cellphones — the young pioneers of the digital age. Perhaps, some suggest, technology has connected them in one sense, but pushed them away from each other in another. "It's very shallow, a lot of these connections," said Jean Twenge, coauthor of "The Narcissism Epidemic: Living in the Age of Entitlement." "You don't really have an emotional connection with someone on Facebook."

Perhaps, others argue, the problem is the advent of 24-hour cable and Internet news; young people today have been inundated with news to the point that they cannot care anymore. The oil spill in Louisiana this week, the flood in Pakistan next week — the tragedies all run together, making it harder to care in any sort of sustained way. Parenting could also be at fault, Konrath speculated. Perhaps today's less empathetic children were raised by more narcissistic parents. Or the problem could be a hypercompetitive world in which everyone is trying to get into the best schools, get ahead, get more.

It's possible, some psychologists argue, that people haven't changed so much as the world around us has. Innately, they suggest, young people today still care as much as they once did. But at a time when jobs are scarce, the economy is sputtering, our politics are filled with anger, and people often feel powerless to address the problems in their own lives — much less affect big issues like climate change — perhaps young Americans are just evolving to focus on what matters most: their own tiny worlds.

"I'd be extremely surprised if it turns out that students were now less capable of caring for other people — their friends, romantic partners, family, or pets," Batson said. "The idea that they're less capable of caring than they were 20 years ago — that just seems unlikely. I don't think we change like that. But our situation may have changed. One may feel pressure to pull back on the scope of one's concern. Pull it back and say, 'I've got to deal with the needs that are pressing right here.'"

Konrath also warns that it's hard to know if the problem is as acute as the study shows. College students aren't a representative slice of America. In order to know if empathy is truly declining, Konrath said, she would need to run a study that captures the full picture of the populace — research that her group has already started. And though the findings aren't published yet, Konrath said, the early indications are that the national findings support what they have already found. "People who were born in the '80s or later," she said, "are lowest in empathy, regardless of whether they have a college degree or not."

Still, she is trying to stay upbeat about the present and the future. If empathy can go down, she said, it can also go up. It's malleable. But still there's reason for concern, just knowing how a lack of empathy can affect society.

In recent years, W. Keith Campbell, Twenge's coauthor and a professor of psychology at the University of Georgia, has run a series of experiments where he places four people in charge of forestry companies harvesting an imaginary 200-hectare forest. He gives them permission to cut down 10 hectares a year, stipulating that 10 percent will grow back. The question before the participants is: Will they limit their short-



term gains for the long-term good of the group? Or will they cut down as many trees as possible, thereby exhausting the resource for everyone much faster?

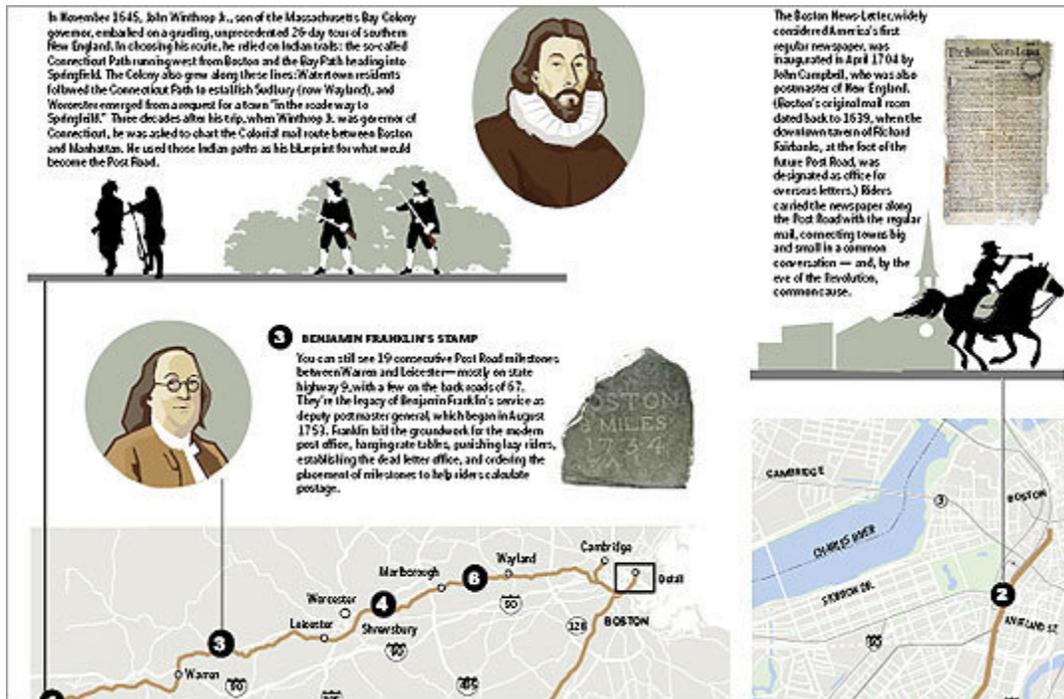
The narcissists — those focused primarily on themselves — always do well, Campbell said, harvesting more trees than the others in the group. But soon enough, the system is destroyed and everyone is worse off.

“So if you have a society where a lot of people are narcissistic, the whole thing blows up,” he said. “It implodes.”

*Freelance writer Keith O’Brien, winner of the Casey Medal for Meritorious Journalism, is a former staff writer for the Globe. E-mail him at [keith@keithob.com](mailto:keith@keithob.com).*

[http://www.boston.com/bostonglobe/ideas/articles/2010/10/17/the\\_empathy\\_deficit/#](http://www.boston.com/bostonglobe/ideas/articles/2010/10/17/the_empathy_deficit/#)

## The road that built us How the Post Road wrote New England's history



Without knowing it, you've almost surely walked it or driven it, maybe on your way to the grocery store in Wayland, or a restaurant in the South End. (By Text by Eric Jaffe Graphic by Javier Zarracina, Boston Globe) By Text by Eric Jaffe Graphic by Javier Zarracina | October 17, 2010

Without knowing it, you've almost surely walked it or driven it, maybe on your way to the grocery store in Wayland, or a restaurant in the South End.

Since it became America's first mail route back in 1673, the Boston Post Road has connected Boston to New York City, delivering messages, guiding travelers, and tying the Northeast together. In that time, some legs of the route have shifted, and most of it is now known by other names — Washington Street, Route 20, Main Street, or Mass. Route 9. But if you know how to follow the thread, you can still trace the Post Road beneath our modern streets and highways. A few stretches, as residents of Marlborough and Sudbury know, among others, are still called Boston Post Road.

The road in its Colonial form began in downtown Boston, at the Old State House, and followed modern Washington Street over what was once a thin neck of land into Roxbury. It split into two branches at the "parting stone" near what's now Roxbury Crossing; the northern branch linked Boston and Springfield (with a spur up through Cambridge) before hooking toward Hartford, while the southern branch ran through Providence to New Haven. There the branches unified en route to New York.

To trace the Post Road through its history is to witness how important one connective thread can be to a growing region — and how it can still determine the shape of the city and state hundreds of years later.

*Eric Jaffe is the author of "The King's Best Highway: The Lost History of the Boston Post Road, the Route That Made America," recently published by Scribner. ■*

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## Unleash the dogs of capitalism



(Peter

Morrison/AP Photo ) Boarded up shops are seen on Sandy Row, Belfast, Northern Ireland. The British economy has officially sunk into recession, government statistics showed Friday, with output falling 1.5 percent in the fourth quarter of last year as the financial crisis ravaged banks, retail and manufacturing.

### What should come after disarmament? How about tax policy?

By Kevin Cullen | October 17, 2010

As Owen Paterson works the room in Washington on Tuesday, schmoozing at a job creation conference for Northern Ireland hosted by Secretary of State Hillary Clinton, prospective investors may be tempted to do a double take at his name tag.

Paterson is an Englishman, Britain's secretary of state for Northern Ireland. But when it comes to tax policy, his pitch is decidedly Irish.

In fact, when it comes to tax policy, Paterson wants to out-Irish the Irish.

The Republic of Ireland's economy, troubled at present due to a meltdown of its housing and banking sectors, was for much of the last two decades the fastest-growing in Europe. Much of the credit for that growth was attributed to the Republic's 12.5 percent corporate tax rate, the lowest in Europe, which enticed many multinational companies, especially American ones, to establish a gateway to Europe there.

Northern Ireland, saddled with a 28 percent rate like the rest of the United Kingdom, could only look south with envy. Who would open a business in Belfast or Derry when they could drive an hour south, on the same island, and pay less than half as much tax?

Paterson hopes to change that equation. Next month he will present a policy paper to the power-sharing Northern Ireland Assembly, recommending a drastic cut in the corporate tax rate. Paterson will call for undercutting the Republic by instituting a 10 percent rate. At the very least, he said, the rate in Northern Ireland needs to match the Republic's.

Paterson and his boss, Prime Minister David Cameron, want to reverse a decades-old policy of building and sustaining peace by heavy government spending. It's time, they say, for Northern Ireland's vaunted peace process to be pushed along by the natural flow of free market capitalism, not the artificial stream of state subsidy.

“I know that’s revolutionary,” Paterson said recently, sitting in Emmet’s, a pub on Boston’s Beacon Hill named for a 19th-century Irish rebel who was executed by the British in Dublin. “But it’s irresponsible to do nothing. We have to give the private sector a chance to grow.”

For many years, the prevailing model in post-conflict societies like Ireland has been to buy off the combatants (or their constituents) with publicly funded jobs and huge state-funded bureaucracies. But now a new idea has begun to gain traction: transforming divided societies by encouraging the private sector. Writing recently in *Foreign Affairs*, Carl J. Schramm, president and CEO of the Ewing Marion Kauffman Foundation and coauthor of “Good Capitalism, Bad Capitalism,” suggested the traditional approach of international development in post-conflict and post-disaster societies has to shift. In Iraq and Afghanistan, he notes, the economies are faltering despite the infusion of billions of dollars because massive public spending creates dependence instead of innovation. A faltering economy, meanwhile, threatens whatever political progress is made.

“There is a proven model for just such economic growth right in front of US policy makers’ eyes: the entrepreneurial model practiced in the United States and elsewhere,” Schramm wrote. “This model rests to a huge extent on the dynamism of new firms, which constantly introduce innovations into the economy.” In Northern Ireland, public spending constitutes 77 percent of GDP, more than twice what is found in many other regions of the United Kingdom. The vast majority of people work for the government or government-funded agencies. The private sector is tiny and hasn’t grown in the decade since the worst of the violence ended.

Those government subsidies, meanwhile, underwrite the separate but equal division of social services, from schools to health clinics, that may have helped keep the peace but has also kept most Catholic nationalists and Protestant unionists living parallel lives without much interaction. Some estimates place the duplication of services in Northern Ireland, a place roughly the size of Connecticut with a population of less than 2 million, at more than \$1 billion a year.

While the infusion of billions from the British exchequer helped remove many of the biggest grievances at the heart of the conflict in Northern Ireland, especially the inequality in housing, the failure to develop a real market economy has held back the cause of integration and reconciliation.

Tax equalization on the island of Ireland would be one step toward making its unification more realistic. But losing that competitive advantage over Northern Ireland would test the Republic’s commitment to unity. Ironically, some of the strongest voices calling for tax equalization belong to unionists, those who want Northern Ireland to remain part of the United Kingdom. Unionists tend to be overrepresented in Northern Ireland’s relatively small entrepreneurial class, and they appear to view tax equalization as gaining an equal footing, not a slide down a slippery slope.

Paterson acknowledges that weaning people in Northern Ireland from such a heavily subsidized society “is a huge cultural shift.” But the cuts are coming anyway. A sweeping overhaul of the UK’s welfare system and shrinking of state spending is the centerpiece of the coalition government led by Cameron, the Conservative Party leader. The Labor government that did so much to propel the political process that led to peace steadfastly refused to lower Northern Ireland’s corporate tax rate as a way to stimulate investment.

For Paterson, an admirer of former prime minister Margaret Thatcher, and an avowed Euroskeptic, his enthusiasm for free market economics and thumbing his nose at the mandarins in Brussels who frown on low corporate taxes are complementary positions.

But can a Thatcherite normalize Northern Ireland?

Paterson said American business officials he met in Washington and Boston on a recent visit were intrigued by the prospect of cutting the tax rate.

“Smart people realize this is a good time to get into Northern Ireland,” he said.

Pdraig O’Malley, the Moakley Professor of Peace and Reconciliation at the University of Massachusetts Boston, and director of the Forum for Cities in Transition from Conflict, agrees that Northern Ireland needs to wean itself from the British taxpayer.

But he said emulating the Republic’s recipe for promoting investment with low taxes looks less attractive while surveying its current budget deficit and stagnant growth. Some companies have left Ireland for better



deals in the Far East and elsewhere. He thinks Chinese companies might be more tempted to locate in Northern Ireland than American ones if the tax rate is dramatically lowered.

How much a company pays in taxes is just one of many factors that go into a decision to locate in a particular country. Some countries in Europe lowered their tax rates in response to the Republic of Ireland's success, but none came close to going as low as 12.5 percent. The low-tax approach to attract business is more common in parts of Asia.

Getting politicians in Northern Ireland to agree to reducing tax revenue while simultaneously absorbing drastic public funding cuts, all in the name of creating a more normal economy and society, will be the biggest test of their fledgling power-sharing democracy.

"It's up to them," Paterson said. "But the status quo is not acceptable."

*Kevin Cullen, a Globe columnist, formerly headed Globe bureaus in Dublin and London. ■*

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**A new lens****The rise of 'optic,' and how we love shiny toys**

By Wendalyn Nichols | October 17, 2010

The trouble with being a lexicographer is that you're often less interested in the point someone is making than in the language they use to make it.

This happened to me not long ago when I was listening to the morning news. "We're seeing this through the optic of our idea of democracy," a political pundit said.

"Hang on," I thought. "When did *optic* replace *lens*?"

This wasn't a case of the trendy use of *optics* to mean "outward appearances" — the public-relations concern over how the look of something affects people's perceptions of it (as in a recent Washington Examiner article that mentioned the "need to control the optics of" lifting the oil drilling ban). The speaker was using "optic" in the sense of perspective, and it was a use I recognized from somewhere else entirely, the *optique* of French literary theory.

In French, the word *optique* has meant "point of view" at least since the 19th century. It jumped into English in the 1960s through translations of theorists like Roland Barthes, who used it to refer to a reader's perspective in responding to a text. From there it entered the prose of academics writing in English; by 1991, M. Keith Booker was writing about "reading Chaucer through the optic of postmodernism." But how and when did the word make it out of academia?

Political theory is a likely channel. We can see a nice example of literary and political theory overlapping in the title of a 1999 article by Michael Null in *Shakespeare Quarterly*: "Broken English and Broken Irish: Nation, Language, and the Optic of Power in Shakespeare's Histories." *Optic* here is referring to a nationalist viewpoint, a use we also see in the book "A World Without Islam," in which its author, Graham Fuller, says, "The problem lies in the optic we employ....[W]e believe we are essentially out there, just minding our own business, trying to help make the world right."

This political use of *optic* is the one I heard on the radio, and it seems to be preferred over *perspective* or *lens* when what's meant is something less unconscious and more chosen about the way one sees the world. And that's an interesting development to watch. The stock-in-trade of lexicographers is language change: How are people using words? Is a new meaning developing, or is an older meaning migrating to a new context? It's fairly common knowledge that English happily borrows words from other languages and loves a good new coinage. Something sparkly like *optic* catches our attention, and we shove aside a perfectly serviceable word like *lens* (a much earlier adoption) to make room for it, often giving it a nuance of meaning that justifies our having swiped it.

English will often raid its own attic, too. Wherever a word or phrase came from originally, if it's been in the language for a while and is in active use, chances are if the meaning hasn't shifted yet, it will. Take the word *parse*, which means to break out and describe in detail the grammar of each part of a sentence. We've hauled it out of its specialized jargon drawer and given it a good airing, but along the way we've diluted its meaning. Now we see headlines like "Candidates for Maine House Parse Economy" and even "Parse Out the Parking Issue." Compared with *parsing* something, *clarifying* or *explaining* seem so, well, 20th century, don't they? The use of *parse* in an abstract sense at least has a little history behind it. But many times, a shift in meaning happens without much warning. For instance, the current business-world use of *monetize* — roughly "to make money out of" ("How can we monetize our website?") — hasn't even made it into mainstream dictionaries yet. In the sense that economists use the verb, if you monetize an asset or a debt, you convert it into money. If you monetize an economy, you convert a barter system to a money system. It's not a stretch to see how the older, specialized meanings lent themselves to the extended one, but clearly it has happened too fast for dictionaries to keep up.

Tracing exactly how and when a new use sprang up can be like trying to pinpoint the first dandelion in a field that's been overrun with them. The first seed might be from an influential academic, author, or pundit — anyone who's a popular talking head. Those who want to sound as though they're smart and in the know pick it up, sometimes mangling it through misunderstanding. Suddenly, the term is everywhere, like yellow flowers in a yard.



In some cases, a word's new use, whether coined, borrowed, or adapted, fills a gap: A newly invented technology needs a name, or another language has just the word for a concept it takes us a sentence to describe. But many times there isn't a hole in English; we didn't really need a new word for "make money from," or "figure out," or "perspective." It's just that when we see a new model, we like to trade up. I don't ask whether the reason is pretension or bandwagon-jumping or insecurity or love of the new. I'm just fascinated when it happens. I'm sorry; what was your point?

*Wendalyn Nichols is the US commissioning editor for Cambridge ELT Dictionaries, [www.dictionary.cambridge.org](http://www.dictionary.cambridge.org), and the editor of Copyediting newsletter. ■*

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## Is Pure Altruism Possible?

By JUDITH LICHTENBERG



The Stone is a forum for contemporary philosophers on issues both timely and timeless.

Who could doubt the existence of altruism?

True, news stories of malice and greed abound. But all around us we see evidence of human beings sacrificing themselves and doing good for others. Remember Wesley Autrey? On Jan. 2, 2007, Mr. Autrey jumped down onto the tracks of a New York City subway platform as a train was approaching to save a man who had suffered a seizure and fallen. A few months later the Virginia Tech professor Liviu Librescu blocked the door to his classroom so his students could escape the bullets of Seung-Hui Cho, who was on a rampage that would leave 32 students and faculty members dead. In so doing, Mr. Librescu gave his life.

The view that people never intentionally act to benefit others except to obtain some good for themselves still possesses a powerful lure over our thinking.

Still, doubting altruism is easy, even when it seems at first glance to be apparent. It's undeniable that people sometimes act in a way that benefits others, but it may seem that they always get something in return — at the very least, the satisfaction of having their desire to help fulfilled. Students in introductory philosophy courses torture their professors with this reasoning. And its logic can seem inexorable.

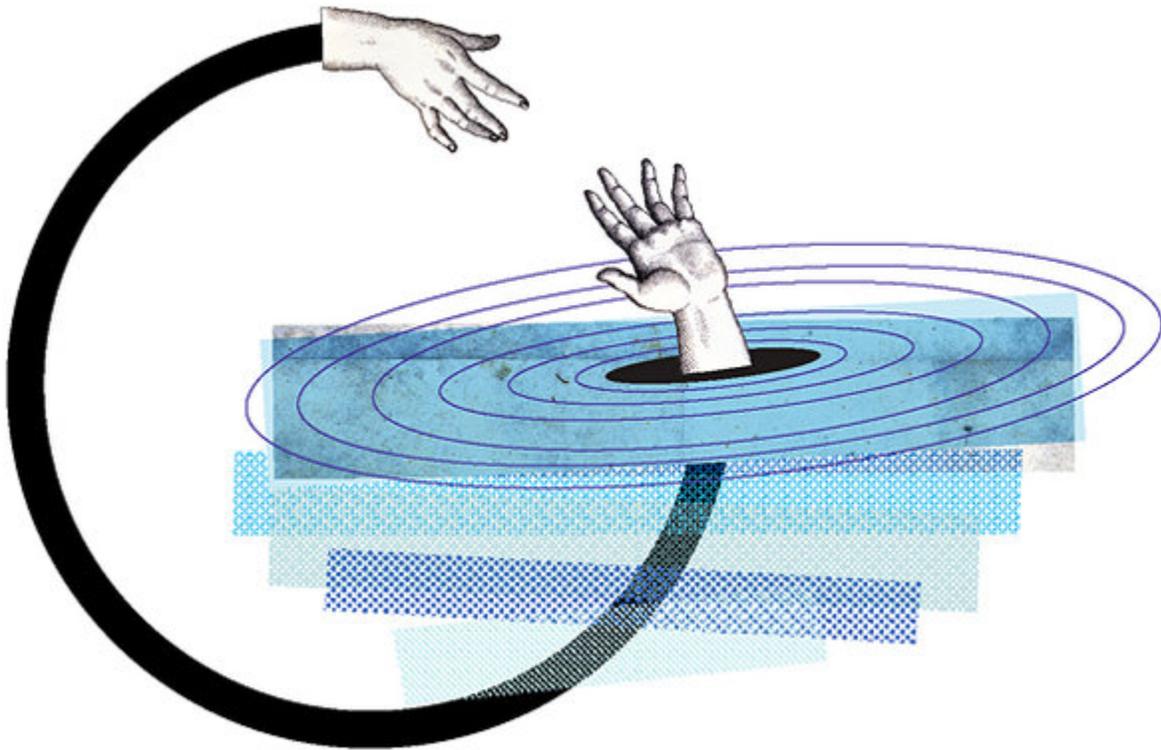
Contemporary discussions of altruism quickly turn to evolutionary explanations. Reciprocal altruism and kin selection are the two main theories. According to reciprocal altruism, evolution favors organisms that sacrifice their good for others in order to gain a favor in return. Kin selection — the famous “selfish gene” theory popularized by Richard Dawkins — says that an individual who behaves altruistically towards others who share its genes will tend to reproduce those genes. Organisms may be altruistic; genes are selfish. The feeling that loving your children more than yourself is hard-wired lends plausibility the theory of kin selection.

These evolutionary theories explain a puzzle: how organisms that sacrifice their own “reproductive fitness” — their ability to survive and reproduce — could possibly have evolved. But neither theory fully accounts for our ordinary understanding of altruism.

The defect of reciprocal altruism is clear. If a person acts to benefit another in the expectation that the favor will be returned, the natural response is: “That’s not altruism!” Pure altruism, we think, requires a person to sacrifice for another without consideration of personal gain. Doing good for another person because something’s in it for the do-er is the very opposite of what we have in mind. Kin selection does better by allowing that organisms may genuinely sacrifice their interests for another, but it fails to explain why they sometimes do so for those with whom they share no genes, as Professor Librescu and Mr. Autrey did.

When we ask whether human beings are altruistic, we want to know about their motives or intentions.

Biological altruism explains how unselfish behavior might have evolved but, as Frans de Waal suggested in his column in The Stone on Sunday, it implies nothing about the motives or intentions of the agent: after all, birds and bats and bees can act altruistically. This fact helps to explain why, despite these evolutionary theories, the view that people never intentionally act to benefit others except to obtain some good for themselves still possesses a powerful lure over our thinking.



Erin Schell

The lure of this view — egoism — has two sources, one psychological, the other logical. Consider first the psychological. One reason people deny that altruism exists is that, looking inward, they doubt the purity of their own motives. We know that even when we appear to act unselfishly, other reasons for our behavior often rear their heads: the prospect of a future favor, the boost to reputation, or simply the good feeling that comes from appearing to act unselfishly. As Kant and Freud observed, people’s true motives may be hidden, even (or perhaps especially) from themselves. Even if we think we’re acting solely to further another person’s good, that might not be the real reason. (There might be no single “real reason” — actions can have multiple motives.)

So the psychological lure of egoism as a theory of human action is partly explained by a certain humility or skepticism people have about their own or others’ motives. There’s also a less flattering reason: denying the possibility of pure altruism provides a convenient excuse for selfish behavior. If “everybody is like that” — if everybody *must* be like that — we need not feel guilty about our own self-interested behavior or try to change it.

The logical lure of egoism is different: the view seems impossible to disprove. No matter how altruistic a person appears to be, it’s possible to conceive of her motive in egoistic terms. On this way of looking at it, the guilt Mr. Autrey would have suffered had he ignored the man on the tracks made risking his life worth the gamble. The doctor who gives up a comfortable life to care for AIDS patients in a remote place does what she wants to do, and therefore gets satisfaction from what only appears to be self-sacrifice. So, it seems, altruism is simply self-interest of a subtle kind.

The kind of altruism we ought to encourage is satisfying to those who practice it.

The impossibility of disproving egoism may sound like a virtue of the theory, but, as philosophers of science know, it’s really a fatal drawback. A theory that purports to tell us something about the world, as egoism does, should be falsifiable. Not false, of course, but capable of being tested and thus proved false. If every state of affairs is compatible with egoism, then egoism doesn’t tell us anything distinctive about how things are.

A related reason for the lure of egoism, noted by Bishop Joseph Butler in the 18th century, concerns ambiguity in the concepts of desire and the satisfaction of desire. If people possess altruistic motives, then they sometimes act to benefit others without the prospect of gain to themselves. In other words, they desire the good of others for its own sake, not simply as a means to their own satisfaction. It's obvious that Professor Librescu desired that his students not die, and acted accordingly to save their lives. He succeeded, so his desire was satisfied. But *he* was not satisfied — since he died in the attempt to save the students. From the fact that a person's desire is satisfied we can draw no conclusions about effects on his mental state or well-being.

Still, when our desires are satisfied we normally experience satisfaction; we feel good when we do good. But that doesn't mean we do good only in order to get that "warm glow" — that our true incentives are self-interested (as economists tend to claim). Indeed, as de Waal argues, if we didn't desire the good of others for its own sake, then attaining it wouldn't produce the warm glow.

Common sense tells us that some people are more altruistic than others. Egoism's claim that these differences are illusory — that deep down, everybody acts only to further their own interests — contradicts our observations and deep-seated human practices of moral evaluation.

At the same time, we may notice that generous people don't necessarily suffer more or flourish less than those who are more self-interested. Altruists may be more content or fulfilled than selfish people. Nice guys don't always finish last.

But nor do they always finish first. The point is rather that the kind of altruism we ought to encourage, and probably the only kind with staying power, is satisfying to those who practice it. Studies of rescuers show that they don't believe their behavior is extraordinary; they feel they must do what they do, because it's just part of who they are. The same holds for more common, less newsworthy acts — working in soup kitchens, taking pets to people in nursing homes, helping strangers find their way, being neighborly. People who act in these ways believe that they ought to help others, but they also want to help, because doing so affirms who they are and want to be and the kind of world they want to exist. As Prof. Neera Badhwar has argued, their identity is tied up with their values, thus tying self-interest and altruism together. The correlation between doing good and feeling good is not inevitable— inevitability lands us again with that empty, unfalsifiable egoism — but it is more than incidental.

### **Related**

#### **More From The Stone**

Read previous contributions to this series.

Altruists should not be confused with people who automatically sacrifice their own interests for others. We admire Paul Rusesabagina, the hotel manager who saved over 1,000 Tutsis and Hutus during the 1994 Rwandan genocide; we admire health workers who give up comfortable lives to treat sick people in hard places. But we don't admire people who let others walk all over them; that amounts to lack of self-respect, not altruism.

Altruism is possible and altruism is real, although in healthy people it intertwines subtly with the well-being of the agent who does good. And this is crucial for seeing how to increase the amount of altruism in the world. Aristotle had it right in his "Nicomachean Ethics": we have to raise people from their "very youth" and educate them "so as both to delight in and to be pained by the things that we ought."



*Judith Lichtenberg is professor of philosophy at Georgetown University. She is at work on a book on the idea of charity.*

<http://opinionator.blogs.nytimes.com/2010/10/19/is-pure-altruism-possible/?hp>

## Bringing in Family to Combat Anorexia

By **RONI CARYN RABIN**

At their first family therapy session, Rina Ranalli and her husband tried to coax their anorexic 13-year-old daughter to eat a bagel with cream cheese. What followed was a protracted negotiation.

The girl said she would eat it only if she could have it plain, with nothing on it. The parents countered that they really wanted her to eat it with the cream cheese. Her last offer: she would eat half.

“Does this happen at every meal?” the therapist, Daniel Le Grange, asked them, Ms. Ranalli recalled. He added gently, “It has to stop.”

“It’s anorexic debate, and it’s really not helpful,” Dr. Le Grange said later in an interview. “I will usually turn to the parents and say: ‘Mom and Dad — it’s your decision what she has to eat. You have to make the choices for her, because the anorexia doesn’t allow her to think clearly.’ ”

Unlike traditional treatments for anorexia nervosa in adolescents, in which the patient sees the therapist one on one, this kind of family-based treatment encourages parents to play a pivotal role in restoring their child’s weight while trying to avoid hospitalizations.

It is a demanding program: for the first two weeks of treatment, at least one parent must be available around the clock to supervise meals and snacks, and monitor children between meals to make sure they do not burn off the calories with excessive exercise.

Now a new study by Dr. Le Grange, of the University of Chicago, reports that the family approach, called the Maudsley method after the London hospital where it was developed, not only is more effective than individual therapy but also keeps working even after the treatment ends. The study, published this month in Archives of General Psychiatry, is one of just a handful of clinical trials that have evaluated treatments for anorexia nervosa in adolescents. Researchers randomly assigned 121 patients ages 12 to 18, mostly girls, to a year of either family or individual therapy at the University of Chicago and at Stanford — 24 hours in all.

Twelve months after the treatment had ended, 49 percent of those who had been in family therapy were in full remission, more than double the 23 percent of those who had been in individual therapy. And among patients who were in remission at the end of the treatment itself, only 10 percent of the family-therapy group had relapsed a year later, compared with 40 percent of those who had individual therapy.

Ms. Ranalli said that until she started family-based treatment with her daughter, “I was never given the tools to say, ‘You are going to sit down and eat this, and I will be here for you and help you through this.’ ”

The family method gave her the skills and confidence to approach her daughter’s anorexia the same way she would approach any other disease, whether flu or cancer.

“If you had medicine for your child, you wouldn’t let your child take half a dose,” Ms. Ranalli said. “I would say to her: ‘This is your food — this is your medicine. You’re not leaving the table before you eat it. We will get through this together. I will hold your hand and support you through this.’ ”

Ultimately, she went on, her daughter “realized she was not going to leave the table without eating.”

She and her husband took turns making sure the girl ate three meals a day and plenty of high-calorie snacks; Ms. Ranalli even went to her daughter’s school, where the two were given a private room so she could make sure the child ate lunch. At the beginning, it could take 30 minutes to get through breakfast, and dinner could last hours.

At one of the first sessions of the Maudsley method, the therapist sits in on a family meal to observe the dynamics, Dr. Le Grange said. Everyone in the family has a role: siblings are instructed to clear out once they are finished eating, “not jump up and yell at their sister for not eating or yell at the parent.”

Unlike traditional approaches, the Maudsley method “says we don’t think the parents are to blame for the problem,” Dr. Le Grange said. “We think they’re part of the solution, and should be center stage.” Their job is to be calm, supportive and consistent.

“It’s a daunting task, no doubt, and it would not be right to create the impression that it’s an easy treatment,” Dr. Le Grange said, adding that parents are not to use physical contact to get their child to eat.

Caregivers need to speak with one voice, he said; one parent cannot be telling the child to eat while the other says, “Just give her a break tonight.”

“The parents need to be on the same page — not just the same page, but the same line and the same word and the same letter,” Dr. Le Grange said.

The trial was limited to adolescents who had been ill for a year or less and were at least 75 percent of their ideal body weight, and Michael Strober, director of the eating disorders program at the University of California, Los Angeles, said it was not clear whether the family-based approach would benefit more severely ill patients.

“When patients are losing weight rapidly, it’s rare to be able to turn it around, and they often must move to a higher level of care,” like residential treatment or hospitalization, said Dr. Strober, who was not involved in the study. And some families are so mired in conflict that they cannot work together as required by the family-based treatment.

But many families can “rise to the occasion,” said Harriet Brown, the author of “Brave Girl Eating: A Family’s Struggle With Anorexia,” a book about her own family’s struggle with her daughter’s anorexia. (Ms. Brown has written about eating and weight problems for The New York Times.) While her daughter was in adolescent-focused therapy, she said the therapist told her that parents should not be the “food police,” and that therapy had to get to the root causes of the problem before her daughter would resume eating.

“It doesn’t work that way,” Ms. Brown said in an interview. “You need the physical recovery first, and then the cognitive recovery. The patient is racked with guilt, anxiety, feeling she’s fat and loathsome if she eats — it was our job to be louder and drown out those voices in her head.”

<http://www.nytimes.com/2010/10/19/health/research/19anorexia.html?src=me&ref=health>

## Little Brother is Watching

By WALTER KIRN



Michael Wolf/Bruce Silverstein Gallery

By WALTER KIRN

In George Orwell's "1984," that novel of totalitarian politics whose great mistake was to emphasize the villainy of society's masters while playing down the mischief of the masses, the goal of communications technology was brutal and direct: to ensure the dominance of the state. The sinister "telescreens" placed in people's homes spewed propaganda and conducted surveillance, keeping the population passive and the leadership firmly in control. In the face of constant monitoring, all people could do was sterilize their behavior, conceal their thoughts and carry on like model citizens.

This was, it turns out, a quaint scenario, grossly simplistic and deeply melodramatic. As the Internet proves every day, it isn't some stern and monolithic Big Brother that we have to reckon with as we go about our daily lives, it's a vast cohort of prankish Little Brothers equipped with devices that Orwell, writing 60 years ago, never dreamed of and who are loyal to no organized authority. The invasion of privacy — of others' privacy but also our own, as we turn our lenses on ourselves in the quest for attention by any means — has been democratized.

For Tyler Clementi, the Rutgers University student who recently committed suicide after a live-stream video of an intimate encounter of his was played on the Web, Little Brother took the form of a prying roommate with a webcam. The snoop had no discernible agenda other than silly, juvenile troublemaking, which made his actions more disturbing in certain ways than the oppressive prying of a dictatorship. The roommate, it seems, was acting on impulse, at least initially, and his transgression couldn't be anticipated, let alone defended against. Clementi, unlike Orwell's Winston Smith, who hid from the telescreens whenever possible

and understood that the price of personhood was ceaseless self-censorship and vigilance, had no way of knowing that the walls had eyes. Nor did his unseen observer anticipate the ultimate consequences of his intrusion.

In “1984,” the abolition of personal space was part of an overarching government policy, but nowadays it’s often nothing more than a side effect of wired high spirits. The era of the “viral video,” when footage of some absorbing slice of life can spread overnight around the globe, is bringing out the anarchist in all of us. Sometimes the results are welcome, benign, and the intruder does his subject a favor. Take the young man who taped his girlfriend shimmying in front of a TV attached to a Wii Fit video game. He shot the clip without her knowledge, apparently, and in no time Google and YouTube made her famous. She capitalized on her high profile by appearing on “The Tyra Banks Show.”

There are also times, of course, when Little Brother does a positive service to society by turning the tables on the state and watching the watchers. The other day a video emerged that seemed to show an Israeli soldier dancing in a mocking manner around a cowering Palestinian woman whom he appeared to have under his control. The viewer couldn’t help but be reminded of more shocking pictures from Abu Ghraib — scenes of torture that might never have come to light if Little Brother hadn’t been standing nearby. The irony is that these images, which caused a convulsion of national moral conscience, were taken — in some cases, at least — as photographic boasts or trophies. So giddy with power and numb to its abuses were the camera-wielding prison guards that they indicted themselves with their own antics.

**In the postideological** YouTube-topia that Orwell couldn’t have foreseen, information flows in all directions and does as it pleases, for better or for worse, serving no masters and obeying no party line. The telescreens, tiny, mobile and ubiquitous, at times seem to be working independently, for some mysterious purpose all their own. This morning, when I sat down to write, I was distracted by a story on my computer about a Google Street View camera that snapped pictures of a corpse lying on a bloody street in urban Brazil. I clicked on the link, unable to do otherwise, and up came the awful, disconcerting image. For a moment, I felt like a voyeur, spiritually dirtied by what I saw. A moment later I was checking the weather report and the status of my I.R.A.

Even Big Brother himself was not so cold. He, at least, had a motive for his peeping — to maintain order, to shore up his position and to put down possible rebellions — but I and the countless Little Brothers like me lack any clear notion of what we’re after. A fleeting sensation of omnipotence? The gratification of idle curiosity? Our nonstop trafficking in stolen images, sometimes as consumers and sometimes as producers (is there any meaningful difference anymore?), adds up to a story without a plot. Is it a tragic story? On occasion. It was tragic for Tyler Clementi and for his roommate, who ruined his own life by spying on another’s, but for those who are suddenly lofted to fame and riches by achieving viral visibility, it’s closer to a feel-good comedy.

Ours is a fragmentarian society, infinitely divided against itself and endlessly disrupted from within by much the same technologies that, in Orwell’s somber novel, assured a dull and deadening stability. In some ways, his nightmare vision of state control is cozy and reassuring by comparison. Big Brother may have stifled dissent by forcing conformity on his frightened subjects, but his trespasses were predictable and manageable. What’s more, his assaults on citizens’ privacy left the concept of privacy intact, allowing the possibility that with his overthrow people might live again as they once had.

Little Brother affords us no such luck, in part because he dwells inside us rather than in some remote and walled-off headquarters. In the new, chaotic regime of networked lenses and microphones that point every which way and rest in every hand, permitting us to train them on ourselves as easily as we aim them at one another, the private and public realms are so confused that it’s best to treat them as identical. With nowhere to hide, you might as well perform, dispensing with old-fashioned notions of discretion and personal dignity. If Tyler Clementi had remembered to do this — to yield his personal life to the machine and acknowledge, with Shakespeare, that the world’s a soundstage — he might have shrugged off the embarrassment he suffered and made a reality show of his existence. He might have asked Little Brother into his room instead of choosing, fatally, to keep him out in the only manner he must have thought possible.

<http://www.nytimes.com/2010/10/17/magazine/17FOB-WWLN-t.html?ref=magazine>

## Hunting for the Dawn of Writing, When Prehistory Became History

By **GERALDINE FABRIKANT**



**Olaf Tessmer, Vorderasiatisches Museum, Berlin**

A clay tag from around 3200 B.C. has signs that scholars call proto-cuneiform.

CHICAGO — One of the stars of the [Oriental Institute's](#) new show, “Visible Language: Inventions of Writing in the Ancient Middle East and Beyond,” is a clay tablet that dates from around 3200 B.C. On it, written in cuneiform, the script language of ancient Sumer in Mesopotamia, is a list of professions, described in small, repetitive impressed characters that look more like wedge-shape footprints than what we recognize as writing. In fact “it is among the earliest examples of writings that we know of so far,” according to the institute’s director, Gil J. Stein, and it provides insights into the life of one of the world’s oldest cultures.

The new exhibition by the institute, part of the [University of Chicago](#), is the first in the United States in 26 years to focus on comparative writing. It relies on advances in archaeologists’ knowledge to shed new light on the invention of scripted language and its subsequent evolution.

The show demonstrates that, contrary to the long-held belief that writing spread from east to west, Sumerian cuneiform and its derivatives and Egyptian hieroglyphics evolved separately from each other. And those writing systems were but two of the ancient forms of writing that evolved independently. Over a span of two millennia, two other powerful civilizations — the Chinese and Mayans — also identified and met a need for written communication. Writing came to China as early as around 1200 B.C. and to the Maya in Mesoamerica long before A.D. 500.

“It was the first true information revolution,” Mr. Stein said. “By putting spoken language into material form, people could for the first time store and transmit it across time and space.”

The Oriental Institute spent two years assembling the show, much of which comes from its own collections. However, it did borrow important Sumerian pieces from other institutions, including the clay tablet from the Vorderasiatisches Museum in Berlin, which has never before been seen in the United States.

The Oriental Institute, which opened in 1919, was heavily financed by [John D. Rockefeller Jr.](#), who had been greatly influenced by [James Henry Breasted](#), a passionate archaeologist. Abby Rockefeller had read his best seller “Ancient Times” to her children.

Today the institute, which still has seven digs going on, boasts objects from excavations in Egypt, Israel, Syria, Turkey and Iraq. Many artifacts were acquired from joint digs with host countries with which the

findings were shared. Among the institute's prized holdings is a 40-ton winged bull from Khorsabad, the capital of Assyria, from around 715 B.C.

The exhibition, which runs through March 6, focuses heavily on the Sumerian civilization that flourished between 3500 B.C. and 1800 B.C. in what is now southern Iraq. Until the 1950s experts had believed that the Sumerians influenced the Egyptians, spreading the use of writing westward. But in the 1950s Günther Dryer, a German archaeologist, found writing on bone and ivory tags in an elaborate, probably royal burial site at Abydos in southern Egypt. The depth at which they were buried and subsequent carbon tests proved the pieces to be as old as Sumerian works. Because the marks were different in style, scholars believe that the Egyptians developed their own writing system independently.

Experts are still struggling to understand just how writing evolved, but one theory, laid out at the Oriental Institute's exhibition, places the final prewriting stage at 3400 B.C., when the Sumerians first began using small clay envelopes like the ones in the show. Some of the envelopes had tiny clay balls sealed within. Archaeologists theorize that they were sent along with goods being delivered; recipients would open them and ensure that the number of receivables matched the number of clay tokens. The tokens, examples of which are also in the show, transmitted information, a key function of writing.

Writing as a carrier of narrative did not evolve for another 700 years, as shown in the inscribed versions of the Sumerian epic tale of Gilgamesh, also on display in the institute's general collection.

Although Egyptian hieroglyphics are more broadly familiar than cuneiform, Sumerian writing was done on clay, which is more durable than papyrus. As a result, Sumer is among the best documented of ancient societies.

An important part of the Oriental Institute exhibition's allure is that it describes some of the unknowns that still intrigue archaeologists, including the birth of the alphabet. The show includes a plaque dated from 1800 B.C. that contains signs that seem to be inspired by Egyptian hieroglyphics but that are actually the earliest letters of an alphabetic script representing Semitic languages. It was found near an ancient turquoise mining site in the Sinai Peninsula, in what was part of ancient Egypt, but the men who worked there spoke the Semitic language of the Canaanites.

Because this is one of the first examples of the use of the alphabetic letters, it suggests that the alphabet was inspired by hieroglyphics. Still, no one really knows who the miners were, if they were literate or how they adapted hieroglyphics to write a western Semitic language. But in later discoveries those same forms make up parts of words.

An alphabetic language has a limited number of signs and is easier to both use and to teach than a representational system like hieroglyphics. An alphabet allows a more rapid spread of literacy and communications. Today almost all languages except Chinese and Japanese are alphabetic. The lack of an alphabet makes Chinese particularly difficult for foreigners. But if Chinese bears little similarity to languages elsewhere in the world, its origins — like the origins of hieroglyphics — have to do with the gods. Bones from ancient Chinese tombs, also on display at the Oriental, were used to help divine the future. The inscriptions on them are the earliest form of Chinese writing, and they make statements about events, such as a battle or the birth of a royal child, and also, in effect, ask how they will come out. Hot brands were put into hollows carved into turtle shells, and the configurations of the resulting cracks were interpreted as answers to important questions.

Less is known about the earliest phases and origin of Mayan writing. Much of the work under way concentrates on artifacts from the Mayans' later period, around A.D. 600. The exhibition includes a Mayan stone monument showing the face of a dead Mayan lord. It carries his name and the date of the dedication of the stone.

To Christopher E. Woods, associate professor of Sumerology at the University of Chicago and the curator of the show, it was important to include examples from all four cultures because the goal of the exhibition was "to present and describe the four times in history when writing was invented from scratch."

<http://www.nytimes.com/2010/10/20/arts/design/20writing.html?ref=design>

## Man of Steel's Industrial Web, Mirroring Nature

By **HILARIE M. SHEETS**

Treadwell, N.Y



Phil Mansfield for The New York Times

Branching systems: “Distillation,” by the sculptor Roxy Paine, is being welded together at his home and studio in Treadwell, N.Y.

By **HILARIE M. SHEETS**

ROXY PAINE’S stainless-steel Dendroid sculptures seem straightforward enough at first, clearly recognizable as treelike forms. But they always manage to veer into ambiguous territory.

“Maelstrom,” for example, displayed on the roof of the Metropolitan Museum of Art last year, posed as a mass of fallen trees in the aftermath of a storm. Yet its branches were exhibiting decidedly unbranchlike behavior: fusing and connecting in the manner of neuron paths or pulses of energy.

Mr. Paine’s Dendroids are never really just about trees.

“Distillation,” the most complex and immersive in his series of 22 Dendroids, is now barreling through the James Cohan Gallery in New York.

Here Mr. Paine pushes the metaphoric content that underpins these sculptures to new extremes. It still uses arboreal forms, but they now mesh with other overtly defined branching systems: a vascular network of arteries and veins with two plump kidneys, mushroom colonies and their germinating mycelia, neuron bundles and taxonomic diagrams, and raw pipelines connected to steel tanks and industrial valves.

“‘Distillation’ is a meditation on seeking purity, the pure essence of something, but at the same time the piece is very impure,” Mr. Paine said last month during a tour of the piece, which was in the final stages of welding at his studio here in Treadwell, in the Catskills. He pointed out how the industrial pipeline flows from the kidney into a tank, for instance, and that the pipeline has fungus growing on it. “It also relates to the way I’ve always thought about my process. How ideas come in coarse and ferment in the brain, and eventually are distilled out of that brew. It’s a map of the way humans constantly flit between different frames of mind and fields of knowledge.”

Each one of his Dendroids is made from standard industrial piping — the kind typically used by the pharmaceutical industry and nuclear power plants — that Mr. Paine bends, welds, grinds and polishes into

seamless organic forms. They mirror nature but always retain their gleaming industrial artifice. That dichotomy reflects the artist's ambivalent feelings about tampering with nature.

"I'm skeptical about the potential for horrible consequences, consistently realized," he said. "But at the same time we are able to feed six billion people through science and altering nature. That's kind of a miracle."

Like his work Mr. Paine, 44, also straddles worlds. He and his family split their time between an apartment in Williamsburg, Brooklyn, and their home in rural Treadwell. In the country he has converted a barn into a full-production metalworking shop that's staffed by about a half-dozen assistants.

Disassembled Dendroids awaiting future installation are splayed out in the surrounding fields, their antlerlike steel components blinding in a strong sun, and beautifully moody in cloudy light. His "100 Foot Line," scheduled to be installed this month at the National Gallery of Canada in Ottawa, is a single tree trunk that tapers to a simple point; it is the antithesis of "Distillation." Next spring Mr. Paine will assemble "Ferment" at the Nelson-Atkins Museum of Art in Kansas City, Mo., and "Inversion" at the Israel Museum in Jerusalem. Under Michael Auping, the chief curator, the Modern Art Museum of Fort Worth acquired Mr. Paine's "Conjoined," two trees whose limbs merge in a web of struggle or attachment. It was first shown in Madison Square Park in New York in 2007.

"It's amazing that Roxy has done as much public work as he has and received so little critical attention," Mr. Auping said. "There is a kind of outsider quality to his work and to him."

Mr. Paine, who grew up in suburban Virginia and left home at 15, has always operated on his own terms. He studied at the Pratt Institute in New York but never graduated and helped form a collective gallery with other artists called Brand Name Damages in Williamsburg in 1990. It was there that he showed his first kinetic sculpture, "Viscous Pult," which flung paint and ketchup with brushes at the gallery window in a rebellious take on action painting.

During the next decade, he became known in the art world for his increasingly sophisticated machines that produced paintings, drawings and sculptures, and for his facsimiles of mushrooms that seemed to sprout from gallery floors or walls. As with Mr. Paine's Dendroid series, these art-making machines and mushroom fields are based on analyzing the visual language of the thing he's replicating, establishing a set of parameters, then finding as much variation as possible within those rules.

For "Distillation," which required about five tons of stainless steel in 5,000 parts, the pipes for the branches use a different lexicon of twists and bends than those for either the neural or vascular systems. The pipes, which come in 30 different diameters, as wide as 14 inches, are each pushed through a hydraulic bender in about 20 discrete moves to make it start to look organic.

Then, based on a detailed model also manipulated in steel, Mr. Paine and his team built the piece and welded the parts together. The pipes and welding seams were typically put through eight stages of grinding and polishing to produce a brilliant luster. But he allowed more of the process to remain evident in some spots, leaving the factory lettering visible on some pipes and the welding seams raw on the kidneys, which were molded from steel plates using a 100-ton press.

Also included in his James Cohan show, running through Dec. 11, is his most complex mushroom piece yet, with about 25 different species of multicolored fungi cropping out from one wall like a color field painting in relief. Each mushroom, made with a stainless-steel structure covered in a type of plastic and painted with lacquer and oils, is true to its species, although it's impossible that these species would ever all be in the same place, let alone on a white gallery wall.

"I'm envisioning a kind of battlefield with these elements, which in nature would be vying for the same food source," said Mr. Paine, noting that such struggles, as between fungus and bacteria, have produced antibiotics. These mushrooms, though, don't show how they were made, as opposed to Mr. Paine's kinetic machines that lay bare the art-making process. But "Distillation" embraces the two approaches.

"I'm deciding as I go whether I want a really smooth kind of flow or something more staccato in certain areas and revealing of the source material," Mr. Paine said. "I think of it in musical terms."

<http://www.nytimes.com/2010/10/17/arts/design/17roxy.html?ref=design>

## One Store, Five Floors, 6,000 Papers

By DANIEL VAN BENTHUYSEN



Eirini Vourloumis for The New York Times

Central Art Supply, in the East Village has been run by the same family for three generations

“PAPER is upstairs.”

Steven Steinberg, 74, the third-generation owner of New York Central Art Supply, says this constantly to bewildered newcomers to his shop on Third Avenue just below 11th Street.

The store is roughly 2,500 square feet, spread over five floors. Half of that space is filled with paper. There are special papers designed for printmaking and watercolor, others for collage and bookbinding. Toned and lace-patterned papers are intended for special packaging or wall treatments. Some papers are made by hand and others made by century-old mills; some cost 60 cents a sheet, and others are priced at hundreds of dollars per sheet.

New York Central’s Web site says the store offers more than 3,000 papers. But David Aldera, the store manager, says that figure is outdated: It is more like 6,000.

Mr. Steinberg’s grandfather, Benjamin Steinberg, started the business in 1905, and it has been in the same spot except for a few years during the 1930s when it was next door. The store was named for its founder’s fondness for the New York Central Railroad — which, Mr. Steinberg happily pointed out, never ran anywhere nearby. Two blocks north, Mr. Steinberg’s sister runs a related business, New York Central Framing Annex. Over the years, the store’s patrons have included many notable artists, among them [James Rosenquist](#), [Eric Fischl](#), April Gornik, Jamie Wyeth, [John Currin](#), [Frank Stella](#) and [Kiki Smith](#). “We don’t see Hockney so much, now that he’s back in England,” Mr. Steinberg said.

Then there are people like Barbara Kulicke, 81, of Blairstown, N.J., who stopped in recently for the durable paper she likes to use for mixed-media projects. “I’ve known Steve for years,” said Ms. Kulicke, an artist whose work has been shown at the Prince Street Gallery. “The prices are comparable to low-end bargain chains, but the service is personal.”



Mr. Aldera, who is 56 and has been working at the store for 30 years, hovers around the second-floor paper department counter, where purchases that cannot or should not be rolled are quickly wrapped in custom-made portfolios. The portfolios are sliced from corrugated cardboard with a box cutter and assembled with the speed and panache of a table-side chef.

“We needed a quick and efficient way to accommodate customers’ purchases,” Mr. Aldera said.

As paper manufacturing declined in the digital era, Mr. Aldera became adept at acquiring stocks of discontinued papers.

“We carry a paper handmade by an elderly man in India — he’s the equivalent of a national treasure, really,” Mr. Aldera said. “He eventually decided he was retiring and would make no more. He had no one to step in and carry on the tradition. We managed to convince him to create one more shipment.”

The paper, MHK Jute, is valued for its resilience and its links with centuries-old papermaking traditions once used in the production of Persian miniatures. Price: \$5 a sheet.

Ask for it upstairs.

<http://www.nytimes.com/2010/10/17/nyregion/17joint.html?ref=design>

## Sniffing out Shoe Bombs: A New and Simple Sensor for Explosive Chemicals



*The handheld reader analyzes the color changes in the sensor array to quickly monitor the environment for explosive chemicals. (Credit: Photo courtesy of Ken Suslick)*

ScienceDaily (Oct. 19, 2010) — University of Illinois chemists have developed a simple sensor to detect an explosive used in shoe bombs. It could lead to inexpensive, easy-to-use devices for luggage and passenger screening at airports and elsewhere.

Triacetone triperoxide (TATP) is a high-powered explosive that in recent years has been used in several bombing attempts. TATP is easy to prepare from readily available components and has been difficult to detect. It defies most standard methods of chemical sensing: It doesn't fluoresce, absorb ultraviolet light or readily ionize.

The few methods available to screen for TATP aren't feasible for on-the-ground use in airports, as they require large, expensive equipment, extensive sample preparation, or relatively high concentrations of TATP in solid or liquid form. There is no simple way to detect TATP vapor.

Kenneth Suslick, the Schmidt Professor of Chemistry at the U. of I., and postdoctoral researcher Hengwei Lin have developed a colorimetric sensor array that can quantitatively detect even very low levels of TATP vapor -- down to a mere 2 parts per billion. They wrote about their findings in an article published in the *Journal of the American Chemical Society*.

To create the sensor array, the researchers print a series of 16 tiny colored dots -- each a different pigment -- on an inert plastic film. A solid acid catalyst breaks down TATP into detectable components that cause the pigments to change color, like litmus paper.

Each pigment changes colors depending on the concentration of TATP in the air. The array is digitally imaged with an ordinary flatbed scanner or an inexpensive electronic camera before and after exposure to the air.

"Imagine a polka-dotted postage stamp sensor that can sniff out the shoe-bomber explosive simply by using a digital camera to measure the changing colors of the sensor's spots," Suslick said. "The pattern of the color change is a unique molecular fingerprint for TATP at any given concentration and we can identify it in a matter of seconds."

The array is uniquely sensitive to TATP. Unlike many other chemical sensors, Suslick and Lin's array is unaffected by changes in humidity or exposure to other chemicals, such as personal hygiene products or laundry detergents. It also has a long shelf life, so airport security and other users can keep a supply on hand. In addition to demonstrating their sensing technique with an ordinary flatbed scanner, the researchers also developed a functional prototype hand-held device. The portable instrument, designed to easily screen luggage or shoes, uses inexpensive white LED illumination and an ordinary digital camera similar to a cell-phone camera.

"The hand-held device makes the whole process portable, sensitive, fast and inexpensive," Suslick said. The hand-held sensor now is being commercialized by iSense, a sensor manufacturer based in Palo Alto, Calif.



"One of the nice things about this technology is that it uses components that are readily available and relatively inexpensive," said David Balshaw, Ph.D. program administrator at National Institute of Environmental Health Sciences, which supported the project.

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**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **University of Illinois at Urbana-Champaign**.

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**Journal Reference:**

1. Hengwei Lin, Kenneth S. Suslick. **A Colorimetric Sensor Array for Detection of Triacetone Triperoxide Vapor**. *Journal of the American Chemical Society*, 2010; 101015130719034 DOI: [10.1021/ja107419t](https://doi.org/10.1021/ja107419t)

<http://www.sciencedaily.com/releases/2010/10/101019152608.htm>

## Drought May Threaten Much of Globe Within Decades, Analysis Predicts

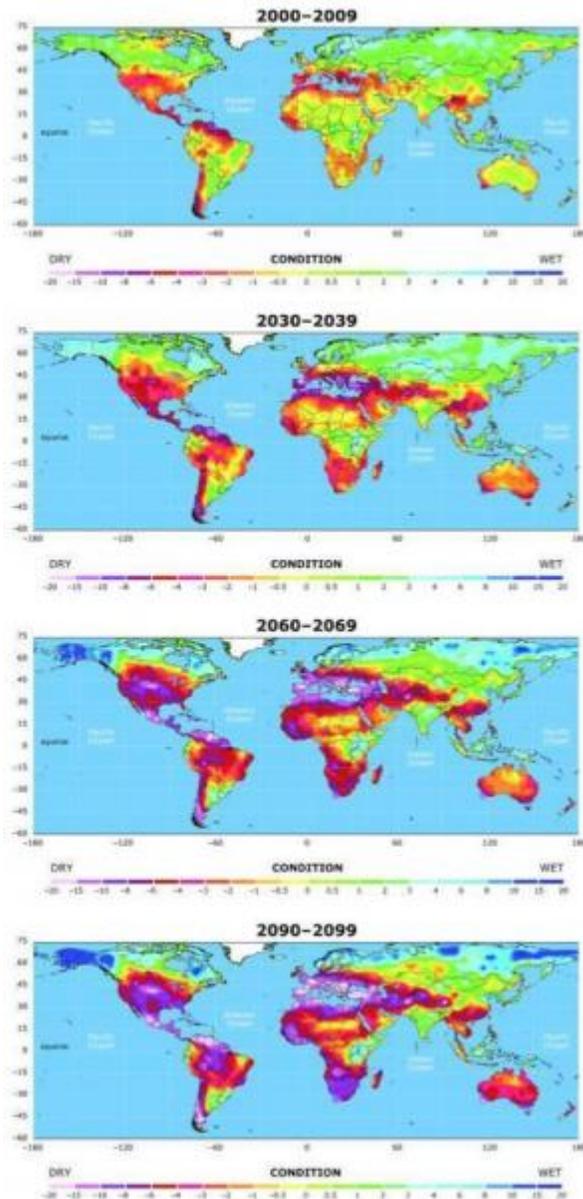
*Future drought: These four maps illustrate the potential for future drought worldwide over the decades indicated, based on current projections of future greenhouse gas emissions. These maps are not intended as forecasts, since the actual course of projected greenhouse gas emissions as well as natural climate variations could alter the drought patterns. The maps use a common measure, the Palmer Drought Severity Index, which assigns positive numbers when conditions are unusually wet for a particular region, and negative numbers when conditions are unusually dry. A reading of -4 or below is considered extreme drought. Regions that are blue or green will likely be at lower risk of drought, while those in the red and purple spectrum could face more unusually extreme drought conditions.* (Credit: Courtesy Wiley Interdisciplinary Reviews, redrawn by UCAR)

ScienceDaily (Oct. 19, 2010) — The United States and many other heavily populated countries face a growing threat of severe and prolonged drought in coming decades, according to a new study by National Center for Atmospheric Research (NCAR) scientist Aiguo Dai. The detailed analysis concludes that warming temperatures associated with climate change will likely create increasingly dry conditions across much of the globe in the next 30 years, possibly reaching a scale in some regions by the end of the century that has rarely, if ever, been observed in modern times. Using an ensemble of 22 computer climate models and a comprehensive index of drought conditions, as well as analyses of previously published studies, the paper finds most of the Western Hemisphere, along with large parts of Eurasia, Africa, and Australia, may be at threat of extreme drought this century.

In contrast, higher-latitude regions from Alaska to Scandinavia are likely to become more moist. Dai cautioned that the findings are based on the best current projections of greenhouse gas emissions. What actually happens in coming decades will depend on many factors, including actual future emissions of greenhouse gases as well as natural climate cycles such as El Niño.

The new findings appear as part of a longer review article in *Wiley Interdisciplinary Reviews: Climate Change*. The study was supported by the National Science Foundation, NCAR's sponsor.

"We are facing the possibility of widespread drought in the coming decades, but this has yet to be fully recognized by both the public and the climate change research community," Dai says. "If the projections in this study come even close to being realized, the consequences for society worldwide will be enormous."



While regional climate projections are less certain than those for the globe as a whole, Dai's study indicates that most of the western two-thirds of the United States will be significantly drier by the 2030s. Large parts of the nation may face an increasing risk of extreme drought during the century.

Other countries and continents that could face significant drying include:

- Much of Latin America, including large sections of Mexico and Brazil
- Regions bordering the Mediterranean Sea, which could become especially dry
- Large parts of Southwest Asia
- Most of Africa and Australia, with particularly dry conditions in regions of Africa
- Southeast Asia, including parts of China and neighboring countries

The study also finds that drought risk can be expected to decrease this century across much of Northern Europe, Russia, Canada, and Alaska, as well as some areas in the Southern Hemisphere. However, the globe's land areas should be drier overall.

"The increased wetness over the northern, sparsely populated high latitudes can't match the drying over the more densely populated temperate and tropical areas," Dai says.

A climate change expert not associated with the study, Richard Seager of Columbia University's Lamont Doherty Earth Observatory, adds:

"As Dai emphasizes here, vast swaths of the subtropics and the midlatitude continents face a future with drier soils and less surface water as a result of reducing rainfall and increasing evaporation driven by a warming atmosphere. The term 'global warming' does not do justice to the climatic changes the world will experience in coming decades. Some of the worst disruptions we face will involve water, not just temperature."

#### **A portrait of worsening drought**

Previous climate studies have indicated that global warming will probably alter precipitation patterns as the subtropics expand. The 2007 assessment by the Intergovernmental Panel on Climate Change (IPCC) concluded that subtropical areas will likely have precipitation declines, with high-latitude areas getting more precipitation.

In addition, previous studies by Dai have indicated that climate change may already be having a drying effect on parts of the world. In a much-cited 2004 study, he and colleagues found that the percentage of Earth's land area stricken by serious drought more than doubled from the 1970s to the early 2000s. Last year, he headed up a research team that found that some of the world's major rivers are losing water.

In his new study, Dai turned from rain and snow amounts to drought itself, and posed a basic question: how will climate change affect future droughts? If rainfall runs short by a given amount, it may or may not produce drought conditions, depending on how warm it is, how quickly the moisture evaporates, and other factors.

Droughts are complex events that can be associated with significantly reduced precipitation, dry soils that fail to sustain crops, and reduced levels in reservoirs and other bodies of water that can imperil drinking supplies. A common measure called the Palmer Drought Severity Index classifies the strength of a drought by tracking precipitation and evaporation over time and comparing them to the usual variability one would expect at a given location.

Dai turned to results from the 22 computer models used by the IPCC in its 2007 report to gather projections about temperature, precipitation, humidity, wind speed, and Earth's radiative balance, based on current projections of greenhouse gas emissions. He then fed the information into the Palmer model to calculate the PDSI index. A reading of +0.5 to -0.5 on the index indicates normal conditions, while a reading at or below -4 indicates extreme drought. The most index ranges from +10 to -10 for current climate conditions, although readings below -6 are exceedingly rare, even during short periods of time in small areas.

By the 2030s, the results indicated that some regions in the United States and overseas could experience particularly severe conditions, with average decadal readings potentially dropping to -4 to -6 in much of the central and western United States as well as several regions overseas, and -8 or lower in parts of the Mediterranean. By the end of the century, many populated areas, including parts of the United States, could



face readings in the range of -8 to -10, and much of the Mediterranean could fall to -15 to -20. Such readings would be almost unprecedented.

Dai cautions that global climate models remain inconsistent in capturing precipitation changes and other atmospheric factors, especially at the regional scale. However, the 2007 IPCC models were in stronger agreement on high- and low-latitude precipitation than those used in previous reports, says Dai.

There are also uncertainties in how well the Palmer index captures the range of conditions that future climate may produce. The index could be overestimating drought intensity in the more extreme cases, says Dai. On the other hand, the index may be underestimating the loss of soil moisture should rain and snow fall in shorter, heavier bursts and run off more quickly. Such precipitation trends have already been diagnosed in the United States and several other areas over recent years, says Dai.

"The fact that the current drought index may not work for the 21<sup>st</sup> century climate is itself a troubling sign," Dai says.

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**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **National Center for Atmospheric Research/University Corporation for Atmospheric Research**.

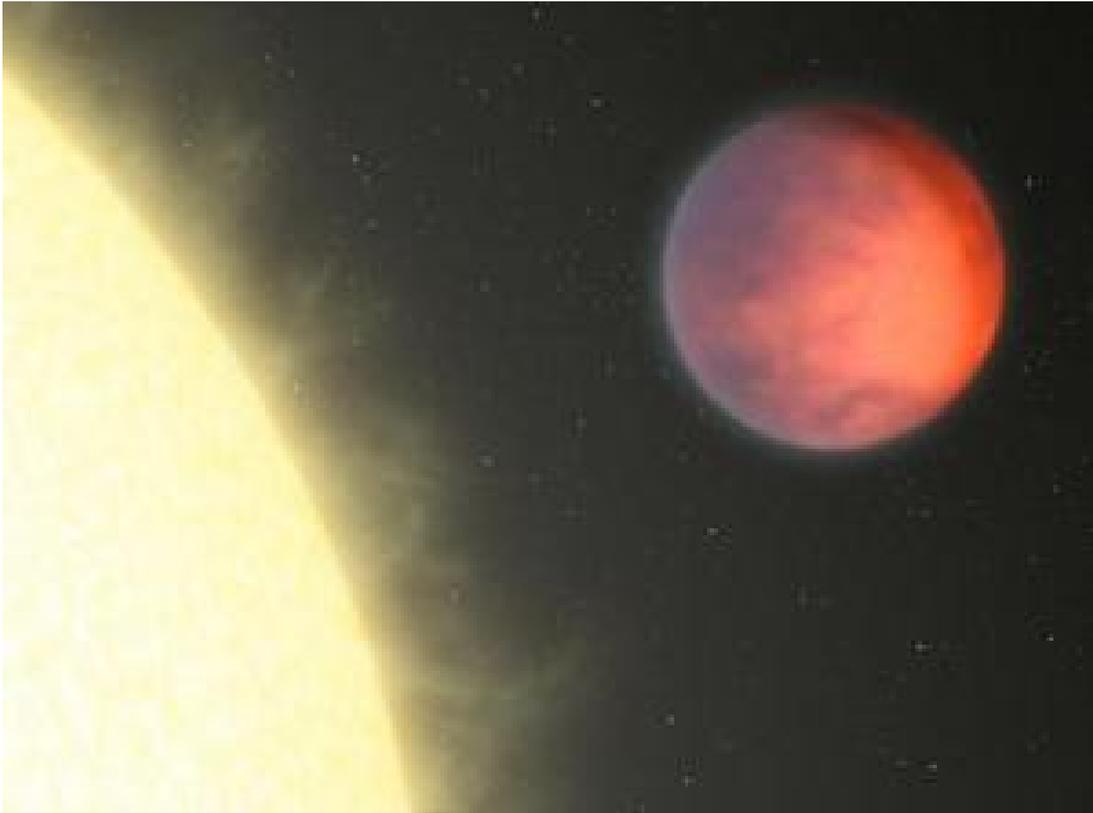
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1. Aiguo Dai. **Drought under global warming: a review**. *Wiley Interdisciplinary Reviews: Climate Change*, 2010; DOI: [10.1002/wcc.81](https://doi.org/10.1002/wcc.81)

<http://www.sciencedaily.com/releases/2010/10/101019121922.htm>

## Astronomers Find Weird, Warm Spot on an Exoplanet



NASA's Spitzer Space Telescope has found that the hottest part of a distant planet, named *upsilon Andromedae b*, is not under the glare of its host star as might be expected. (Credit: NASA/JPL-Caltech) ScienceDaily (Oct. 19, 2010) — Observations from NASA's Spitzer Space Telescope reveal a distant planet with a warm spot in the wrong place.

The gas-giant planet, named *upsilon Andromedae b*, orbits tightly around its star, with one face perpetually boiling under the star's heat. It belongs to a class of planets termed hot Jupiters, so called for their scorching temperatures and large, gaseous constitutions.

One might think the hottest part of these planets would be directly under the sun-facing side, but previous observations have shown that their hot spots may be shifted slightly away from this point. Astronomers thought that fierce winds might be pushing hot, gaseous material around.

But the new finding may throw this theory into question. Using Spitzer, an infrared observatory, astronomers found that *upsilon Andromedae b*'s hot spot is offset by a whopping 80 degrees. Basically, the hot spot is over to the side of the planet instead of directly under the glare of the sun.

"We really didn't expect to find a hot spot with such a large offset," said Ian Crossfield, lead author of a new paper about the discovery appearing in an upcoming issue of *The Astrophysical Journal*. "It's clear that we understand even less about the atmospheric energetics of hot Jupiters than we thought we did."

The results are part of a growing field of exoplanet atmospheric science, pioneered by Spitzer in 2005, when it became the first telescope to directly detect photons from an exoplanet, or a planet orbiting a star other than our sun. Since then, Spitzer, along with NASA's Hubble Space Telescope, has studied the atmospheres of several hot Jupiters, finding water, methane, carbon dioxide and carbon monoxide.

In the new study, astronomers report observations of *upsilon Andromedae b* taken across five days in February of 2009. This planet whips around its star every 4.6 days, as measured using the "wobble," or radial



velocity technique, with telescopes on the ground. It does not transit, or cross in front of, its star as many other hot Jupiters studied by Spitzer do.

Spitzer measured the total combined light from the star and planet, as the planet orbited around. The telescope can't see the planet directly, but it can detect variations in the total infrared light from the system that arise as the hot side of the planet comes into Earth's field of view. The hottest part of the planet will give off the most infrared light.

One might think the system would appear brightest when the planet was directly behind the star, thus showing its full sun-facing side. Likewise, one might think the system would appear darkest when the planet swings around toward Earth, showing its backside. But the system was the brightest when the planet was to the side of the star, with its side facing Earth. This means that the hottest part of the planet is not under its star. It's sort of like going to the beach at sunset to feel the most heat. The researchers aren't sure how this could be.

They've guessed at some possibilities, including supersonic winds triggering shock waves that heat material up, and star-planet magnetic interactions. But these are just speculation. As more hot Jupiters are examined, astronomers will test new theories.

"This is a very unexpected result," said Michael Werner, the Spitzer project scientist at NASA's Jet Propulsion Laboratory, Pasadena, Calif., who was not a part of the study. "Spitzer is showing us that we are a long way from understanding these alien worlds."

The Spitzer observations were made before it ran out of its liquid coolant in May 2009, officially beginning its warm mission.

Other authors of the study are Brad Hansen of UCLA; Joseph Harrington at the University of Central Florida, Orlando; James Y-K. Cho of Queen Mary, University of London, United Kingdom; Drake Deming of NASA's Goddard Space Flight Center, Greenbelt, Md.; Kristen Menou of Columbia University, New York, N.Y.; and Sara Seager of the Massachusetts Institute of Technology, Boston.

JPL manages the Spitzer Space Telescope mission for NASA's Science Mission Directorate, Washington. Science operations are conducted at the Spitzer Science Center at the California Institute of Technology, also in Pasadena. Caltech manages JPL for NASA. For more information about Spitzer, visit <http://spitzer.caltech.edu/> and <http://www.nasa.gov/spitzer>.

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by [NASA/Jet Propulsion Laboratory](#).

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**Journal Reference:**

1. Ian J. Crossfield, Brad M. S. Hansen, Joseph Harrington, James Y-K. Cho, Drake Deming, Kristen Menou, Sara Seager. **A New 24 micron Phase Curve for upsilon Andromedae b.** *The Astrophysical Journal*, 2010; (submitted) [[link](#)]

<http://www.sciencedaily.com/releases/2010/10/101019140028.htm>

## Mutation Over 100 Million Years Ago Led Flowers to Make Male and Female Parts Differently



*Pink snapdragon. Researchers have traced how a gene mutation over 100 million years ago led flowers to make male and female parts in different ways. (Credit: iStockphoto)*

ScienceDaily (Oct. 19, 2010) — Research by University of Leeds plant scientists has uncovered a snapshot of evolution in progress, by tracing how a gene mutation over 100 million years ago led flowers to make male and female parts in different ways.

The findings -- published in the *Proceedings of the National Academy of Sciences (PNAS)* Online Early Edition -- provide a perfect example of how diversity stems from such genetic 'mistakes'. The research also opens the door to further investigation into how plants make flowers -- the origins of the seeds and fruits that we eat.

In a number of plants, the gene involved in making male and female organs has duplicated to create two, very similar, copies. In rockcress (*Arabidopsis*), one copy still makes male and female parts, but the other copy has taken on a completely new role: it makes seed pods shatter open. In snapdragons (*Antirrhinum*), both genes are still linked to sex organs, but one copy makes mainly female parts, while still retaining a small role in male organs -- but the other copy can only make male.

"Snapdragons are on the cusp of splitting the job of making male and female organs between these two genes, a key moment in the evolutionary process," says lead researcher Professor of Plant Development, Brendan Davies, from Leeds' Faculty of Biological Sciences. "More genes with different roles gives an organism added complexity and opens the door to diversification and the creation of new species."

By tracing back through the evolutionary 'tree' for flowering plants, the researchers calculate the gene duplication took place around 120 million years ago. But the mutation which separates how snapdragons and rock cress use this extra gene happened around 20 million years later.

The researchers have discovered that the different behaviour of the gene in each plant is linked to one amino acid. Although the genes look very similar, the proteins they encode don't always have this amino acid. When



it is present, the activity of the protein is limited to making only male parts. When the amino acid isn't there, the protein is able to interact with a range of other proteins involved in flower production, enabling it to make both male and female parts.

"A small mutation in the gene fools the plant's machinery to insert an extra amino acid and this tiny change has created a dramatic difference in how these plants control making their reproductive organs," says Professor Davies. "This is evolution in action, although we don't know yet whether this mutation will turn out to be a dead end and go no further or whether it might lead to further complexities.

"Our research is an excellent example of how a chance imperfection sparks evolutionary change. If we lived in a perfect world, it would be a much less interesting one, with no diversity and no chance for new species to develop."

The researchers now plan to study the protein interactions which enable the production of both male and female parts as part of further investigation into the genetic basis by which plants produce flowers.

The research was supported by funding from the European Union Marie Curie Research Training Program and the Biotechnology and Biological Sciences Research Council.

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**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **University of Leeds**, via EurekAlert!, a service of AAAS.

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**Journal Reference:**

1. Chiara A. Airoidi, Sara Bergonzi, Brendan Davies. **Single amino acid change alters the ability to specify male or female organ identity**. *Proceedings of the National Academy of Sciences*, 2010; DOI: [10.1073/pnas.1009050107](https://doi.org/10.1073/pnas.1009050107)

<http://www.sciencedaily.com/releases/2010/10/101018163100.htm>



## No Standard for the Placebo?



*A new study finds that there is no standard the placebo. (Credit: iStockphoto)*

ScienceDaily (Oct. 19, 2010) — Much of medicine is based on what is considered the strongest possible evidence: The placebo-controlled trial. A paper published in the October 19 issue of *Annals of Internal Medicine* -- entitled "What's In Placebos: Who Knows?" calls into question this foundation upon which much of medicine rests, by showing that there is no standard behind the standard -- no standard for the placebo. The thinking behind relying on placebo-controlled trials is this: to be sure a treatment itself is effective, one needs to compare people whose only difference is whether or not they are taking the drug. Both groups should equally think they are on the drug -- to protect against effects of factors like expectation. So study participants are allocated "randomly" to the drug or a "placebo" -- a pill that might be mistaken for the active drug but is inert.

But, according to the paper's author, Beatrice Golomb, MD, PhD, associate professor of medicine at the University of California, San Diego School of Medicine, this standard has a fundamental problem, "there isn't anything actually known to be physiologically inert. On top of that, there are no regulations about what goes into placebos, and what is in them is often determined by the makers of the drug being studied, who have a vested interest in the outcome. And there has been no expectation that placebos' composition be disclosed. At least then readers of the study might make up their own mind about whether the ingredients in the placebo might affect the interpretation of the study."

Golomb pointed out these limitations to the placebo in a pair of letters to the journal *Nature* 15 years ago. "A positive or negative effect of the placebo can lead to the misleading appearance of a negative or positive effect of the drug," she said. "And an effect in the same direction as the drug can lead a true effect of the drug to be lost. These concerns aren't just theoretical. Where the composition has been disclosed, the ingredients of the placebo have in some instances had a likely impact on the result of the study -- in either direction (obscuring a real effect, or creating a spurious one). In the cases we know about, this is not because of any willful manipulation, but because it can in fact be difficult to come up with a placebo that does not have some kind of problem."

Since 15 years have elapsed, the situation might have improved. Therefore, Golomb and her colleagues analyzed just how often randomized trials published in the past two years in each of the top four general medical journals actually disclosed the makeup of placebos.

The answer is not reassuring, according to the researchers, who found that the placebo ingredients for pills were disclosed in fewer than 10 percent of cases. (The nature of the "control" was significantly more likely to be stated for other types of treatments -- like injections, acupuncture, or surgery -- where people are more likely to question what "placebo" actually means.)

"How often study results are affected by what's in the placebo is hard to say -- because, as this study showed, most of the time we have no idea what the placebo is," Golomb concluded.

Additional contributors to the study included Laura C. Erickson, BS, Sabrina Koperski, BS, Deanna Sack, BS, and UCSD Department of Medicine; Murray Enkin, MD, Departments of Obstetrics and Gynaecology,



McMaster University, Ontario, Canada; and Jeremy Howick, PhD, Centre for Evidence-Based Medicine, University of Oxford, England.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University of California -- San Diego**. The original article was written by Debra Kain.

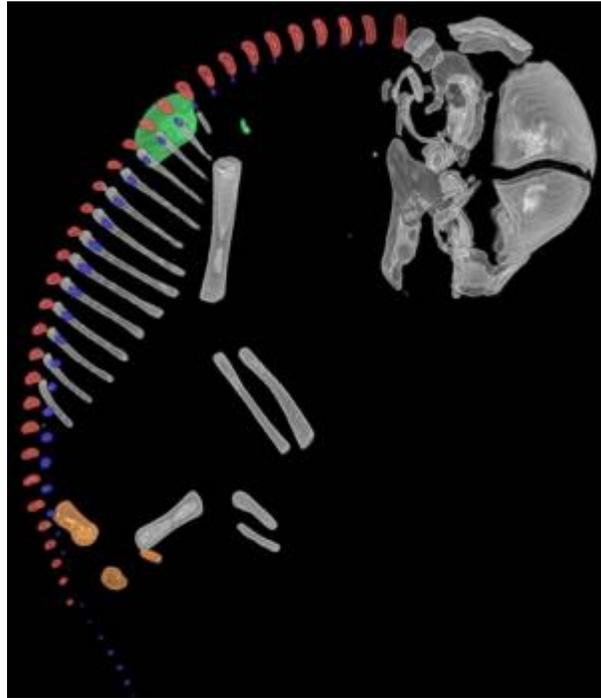
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<http://www.sciencedaily.com/releases/2010/10/101018174335.htm>

## When Vertebrae Cross Dress: How Sloths Got Their Long Neck



*Lateral view of 3D reconstruction of computerized tomography (CT) scan of skeleton in the three-toed sloth *Bradypus tridactylus* (Paris Museum, MNHN 1881-111). This specimen represents a fetus and is approximately 100mm in length. The blue centra extending into the base of the neck are rib-cage vertebrae that have been coopted to form neck vertebrae. During the course of evolution, the shoulder, ribcage, and pelvis have shifted down the vertebral column to make the neck longer. Vertebral neural arches are in red, vertebral centra are in blue, scapula and clavicle are in green, and ischium, ilium, and pubis are in orange (Credit: L. Hautier and R. Asher)*

ScienceDaily (Oct. 18, 2010) — By examining the development of bones in the vertebral column, limbs, and ribcage, scientists at the University of Cambridge have discovered how sloths evolved their unique neck skeleton.

From mice to giraffes, mammals are remarkable in that all but a handful of their 5000 species have exactly seven vertebrae in the neck. Among the few that deviate from this number are three-toed sloths, which may have up to ten ribless vertebrae in the neck.

Traditionally, vertebrae above the shoulders that lack ribs are known as cervical or neck vertebrae. Animals such as birds and lizards show great variety in the number of vertebrae in their neck. For example, a swan may have twice as many as a songbird.

Mammals, on the other hand, are much more conservative. A giraffe has the same number of neck vertebrae as a human, mouse, elephant, or armadillo; all have exactly seven. Sloths are an exception, with up to 10 vertebrae in their neck.

In order to discover if patterns of bone formation in these strange animals give any clues to their divergent vertebral anatomy, scientists based at the University of Cambridge have investigated the development of the skeleton in mammals, focusing on the vertebral column in sloths.

The scientists found that in all mammals except for sloths, bone formation always took place earlier in the body of first few vertebrae of the ribcage than in the neck. The only exception was among three-toed sloths, which show early bone-formation in the bodies of their distal, ribless neck vertebrae, before those of the ribcage.

However, by observing the position of bone-formation within the vertebral column, the investigators made a startling discovery: all mammals, including sloths, show early development of the body of the eighth vertebra down from the head, whether or not it is part of the neck.

In other words, the bottom neck vertebrae of sloths show a similar sequence of development as the top ribcage vertebrae of other mammals, both of which start at eight vertebrae down from the head. This shows that the bottom "neck" vertebrae of sloths are developmentally the same as ribcage vertebrae of other mammals, but lack ribs.

Dr Robert Asher, of the Department of Zoology at the University of Cambridge, said: "The remarkable conservatism of the mammalian neck is apparent even in those few species that superficially seem to be exceptions, like sloths. Even though they've got eight to ten ribless vertebrae above the shoulders, unlike the seven of giraffes, humans, and nearly every other species of mammal, those extra few are actually ribcage vertebrae masquerading as neck vertebrae."

These new results -- published in the *Proceedings of the National Academy of Sciences* -- support the interpretation that the limb girdles and at least part of the ribcage derive from different embryonic tissues than the vertebrae, and that during the course of evolution, they have moved in concert with each other relative to the vertebral column. In three-toed sloths, the position of the shoulders, pelvis, and ribcage are linked with one another, and compared to their common ancestor shared with other mammals, have shifted down the vertebral column to make the neck longer.

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University of Cambridge**, via EurekAlert!, a service of AAAS.

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**Journal Reference:**

1. Lionel Hautier, Vera Weisbecker, Marcelo R. Sánchez-Villagra, Anjali Goswami, Robert J. Asher. **Skeletal development in sloths and the evolution of mammalian vertebral patterning.** *Proceedings of the National Academy of Sciences*, 2010; DOI: [10.1073/pnas.1010335107](https://doi.org/10.1073/pnas.1010335107)

<http://www.sciencedaily.com/releases/2010/10/101018163102.htm>

## Watching Violent TV or Video Games Desensitizes Teenagers and May Promote More Aggressive Behavior, New Study Finds

*Watching violent films, TV programmes or video games desensitises teenagers, blunts their emotional responses to aggression and potentially promotes aggressive attitudes and behaviour, according to new research. (Credit: iStockphoto/Daniel Vineyard)*

ScienceDaily (Oct. 19, 2010) — Watching violent films, TV programmes or video games desensitises teenagers, blunts their emotional responses to aggression and potentially promotes aggressive attitudes and behaviour, according to new research recently published online in the journal *Social Cognitive and Affective Neuroscience*.

Although previous research has suggested that people can become more aggressive and desensitised to real-life violence after repeatedly viewing violent media programmes, little is known about how the extent of watching such programmes and the severity of the aggression displayed affects the brains of adolescents. "It is especially important to understand this because adolescence is a time when the brain is changing and developing, particularly in the parts of the brain that control emotions, emotional behaviour and responses to external events," said Dr Jordan Grafman, who led the research.

Dr Grafman, senior investigator at the National Institute of Neurological Disorders and Stroke, National Institutes of Health (Bethesda, USA), and colleagues recruited 22 boys between the ages of



14-17 to the study. The boys each watched short, four-second clips of violent scenes from 60 videos, arranged randomly in three lots of 20 clips. The degree of violence and aggression in each scene was low, mild or moderate, and there were no extreme scenes. They were asked to rate the aggression of each scene by pressing one of two response buttons at the end of each clip to say whether they thought it was more or less aggressive than the previous video. The boys were positioned in a magnetic resonance imaging scanner that collected data on their brain function while they watched the videos. They also had electrodes attached to the fingers of their non-dominant hand to test for skin conductance responses (SCR). This is a method of measuring the electrical conductance of the skin, which varies with moisture (sweat) levels and is a sensitive way of measuring people's emotions and responses to internal or external stimuli.

Dr Grafman said: "We found that as the boys were exposed to more violent videos over time, their activation in brain regions concerned with emotional reactivity decreased and that was reflected in the data from the functional MRI and in the skin conductance responses."

Data from the SCR showed that the boys became more desensitised towards the videos the longer they watched them and also that they were more desensitised by the mildly and moderately violent videos, but not the ones that contained a low degree of violence. Data on brain activation patterns showed a similar effect. In particular, the area known as the lateral orbitofrontal cortex (IOFC), which is thought to be involved in

emotions and emotional responses to events, showed increasing desensitisation over time, and this was most marked for the most aggressive videos (showing moderate violence) in the study.

The researchers also found that boys who had the most exposure to violent media in their daily lives, as measured by screening tests and questions in their initial meeting with the researchers, showed the greatest desensitisation.

Dr Grafman said: "The important new finding is that exposure to the most violent videos inhibits emotional reactions to similar aggressive videos over time and implies that normal adolescents will feel fewer emotions over time as they are exposed to similar videos. This finding is driven by reduced posterior brain activation and therefore the frontal lobe doesn't react as it normally would.

"The implications of this are many and include the idea that continued exposure to violent videos will make an adolescent less sensitive to violence, more accepting of violence, and more likely to commit aggressive acts since the emotional component associated with aggression is reduced and normally acts as a brake on aggressive behaviour. No prior study has examined this from the complete perspective we had that included behaviour, brain activation, and SCRs in adolescent brains."

As the study recruited only boys, it is not possible to say whether the same effect would be seen in girls. "The incidence rate of aggression in females, even in female teenagers that are exposed to some of the same biopsychosocial challenges as male adolescents, is low and raises the questions of what brain mechanisms and autonomic differences are associated with this gender difference," write the authors.

They conclude: "We propose that exposure to aggressive media results in a blunting of emotional responses, which in turn may prevent the connection of consequences of aggression with an appropriate emotional response, and therefore may increase the likelihood that aggression is seen as acceptable behaviour."

Dr Grafman believes that the findings of the study can be extrapolated to the way people would behave in real life situations. "The electronic media concerned with aggression does stimulate structures in the brain that are typically activated when people imagine being aggressive and, we assume, when they actually are aggressive. Most people can distinguish between playing a video game and real live behaviour, but given the right circumstances where the rules are a bit more ambiguous (what if a bully provokes me) and provocative (someone is trying to take my lunch money), would an adolescent tend to be more aggressive and accept that aggression as normal behaviour given prior exposure to video games? I think so. Particularly if they are a heavy user of games and, in our device-driven world, that will be more and more likely in the future."

**Editor's Note:** This article is not intended to provide medical advice, diagnosis or treatment.

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#### Story Source:

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **Oxford University Press**, via EurekAlert!, a service of AAAS.

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#### Journal Reference:

1. Maren Strenziok, Frank Krueger, Gopikrishna Deshpande, Rhoshel K. Lenroot, Elke van der Meer, and Jordan Grafman. **Fronto-parietal regulation of media violence exposure in adolescents: a multi-method study.** *Social Cognitive and Affective Neuroscience*, 2010 DOI: [10.1093/scan/nsq079](https://doi.org/10.1093/scan/nsq079)

<http://www.sciencedaily.com/releases/2010/10/101018211820.htm>

## Tropics in Decline as Natural Resources Exhausted at Alarming Rate



*United Arab Emirates - Dubai. The top 10 countries with the biggest Ecological Footprint per person are the United Arab Emirates, Qatar, Denmark, Belgium, United States, Estonia, Canada, Australia, Kuwait and Ireland. (Credit: iStockphoto/Giovanni Rinaldi)*

ScienceDaily (Oct. 18, 2010) — New analysis shows populations of tropical species are plummeting and humanity's demands on natural resources are sky-rocketing to 50 per cent more than the earth can sustain, reveals the 2010 edition of WWF's Living Planet Report -- the leading survey of the planet's health. The biennial report, produced in collaboration with the Zoological Society of London and the Global Footprint Network, uses the global Living Planet Index as a measure of the health of almost 8,000 populations of more than 2,500 species. The global Index shows a decrease by 30 per cent since 1970, with the tropics hardest hit showing a 60 per cent decline in less than 40 years.

"There is an alarming rate of biodiversity loss in low-income, often tropical countries while the developed world is living in a false paradise, fuelled by excessive consumption and high carbon emissions," said Jim Leape, Director General of WWF International.

While the report shows some promising recovery by species' populations in temperate areas, thanks in part to greater conservation efforts and improvements in pollution and waste control, tracked populations of freshwater tropical species have fallen by nearly 70 per cent -- greater than any species' decline measured on land or in our oceans.

"Species are the foundation of ecosystems," said Jonathan Baillie, Conservation Programme Director with the Zoological Society of London. "Healthy ecosystems form the basis of all we have -- lose them and we destroy our life support system."

The Ecological Footprint, one of the indicators used in the report, shows that our demand on natural resources has doubled since 1966 and we're using the equivalent of 1.5 planets to support our activities. If we continue living beyond the Earth's limits, by 2030 we'll need the equivalent of two planets' productive capacity to meet our annual demands.

"The report shows that continuing of the current consumption trends would lead us to the point of no return," added Leape. "4.5 Earths would be required to support a global population living like an average resident of the of the US."

Carbon is a major culprit in driving the planet to ecological overdraft. An alarming 11-fold increase in our carbon footprint over the last five decades means carbon now accounts for more than half the global Ecological Footprint.

The top 10 countries with the biggest Ecological Footprint per person are the United Arab Emirates, Qatar, Denmark, Belgium, United States, Estonia, Canada, Australia, Kuwait and Ireland.

The 31 OECD countries, which include the world's richest economies, account for nearly 40 per cent of the global footprint. While there are twice as many people living in BRIC countries -- Brazil, Russia, India and China -- as there are in OECD countries, the report shows the current rate of per-person footprint of the BRIC countries puts them on a trajectory to overtake the OECD bloc if they follow same development path.



"Countries that maintain high levels of resource dependence are putting their own economies at risk," said Mathis Wackernagel, President of the Global Footprint Network. "Those countries that are able to provide the highest quality of life on the lowest amount of ecological demand will not only serve the global interest, they will be the leaders in a resource-constrained world."

New analysis in the report also shows that the steepest decline in biodiversity falls in low-income countries, with a nearly 60 per cent decline in less than 40 years.

The biggest footprint is found in high-income countries, on average five times that of low-income countries, which suggests unsustainable consumption in wealthier nations rests largely on depleting the natural resources of poorer, often still resource rich tropical countries.

The Living Planet Report also shows that a high footprint and high level of consumption, which often comes at the cost of others, is not reflected in a higher level of development. The UN Human Development Index, which looks at life expectancy, income and educational attainment, can be high in countries with moderate footprint.

The Report outlines solutions needed to ensure the Earth can sustain a global population projected to pass nine billion in 2050, and points to choices in diet and energy consumption as critical to reducing footprint, as well as improved efforts to value and invest in our natural capital.

"The challenge posed by the Living Planet Report is clear," said Leape. "Somehow we need to find a way to meet the needs of a growing and increasingly prosperous population within the resources of this one planet. All of us have to find a way to make better choices in what we consume and how we produce and use energy."

More information about the report can be found at:

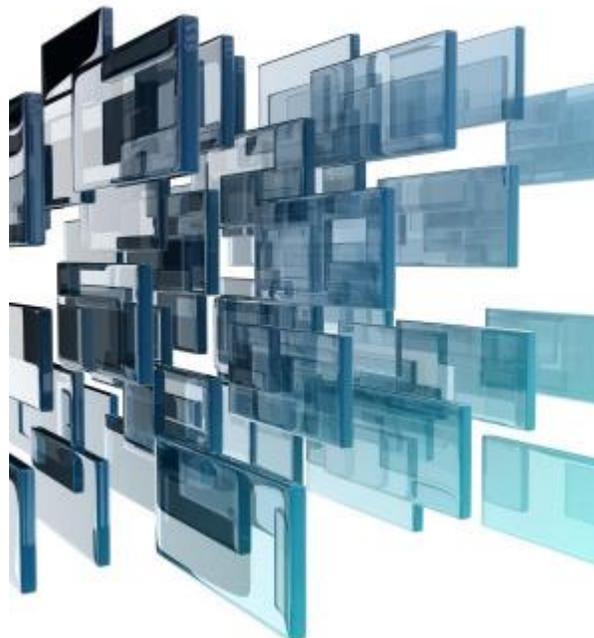
[http://wwf.panda.org/about\\_our\\_earth/all\\_publications/living\\_planet\\_report/](http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/)

**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **World Wildlife Fund**.

<http://www.sciencedaily.com/releases/2010/10/101018162156.htm>

## Unexpected Magnetic Order Among Titanium Atoms Discovered



*Abstract representation of crystalline layers. (Credit: iStockphoto/Xiaoke Ma)*

ScienceDaily (Oct. 18, 2010) — Theoretical work done at the Department of Energy's Oak Ridge National Laboratory has provided a key to understanding an unexpected magnetism between two dissimilar materials. The results, published in *Nature Communications*, have special significance for the design of future electronic devices for computations and telecommunications, according to co-author Satoshi Okamoto of ORNL's Materials Science and Technology Division. The work was performed at Universidad Complutense de Madrid, synchrotron radiation facilities in France and Japan, University of Bristol and University of Warwick. "What the team found was an unexpected magnetic order among the titanium atoms at an interface between strontium titanate and lanthanum manganite, which are both insulators in bulk," Okamoto said. With today's nano-fabrication tools, scientists can develop artificial materials with controlled precision -- almost atom by atom -- of alternating very thin crystalline layers of different materials. The properties of these materials are determined by the structure of interfaces of the different materials and how atoms interact through the interfaces.

Such an interface has traditionally been considered a source of disorder, but in the case of materials such as complex oxides used for this study, the result was something that does not exist naturally in any other material. In order to clarify the electronic properties of such interfaces, the research team made detailed synchrotron X-ray measurements.

"The result was even more surprising as we observed a new type of magnetism in titanium atoms, which are non-magnetic in bulk strontium titanate," Okamoto said.

Furthermore, the researchers were able to manipulate the structure of spin, or magnetism, at atomic scale. The theoretical work by Okamoto provided the key to understand the origin of this novel form of interfacial magnetism and is of particular importance for the development of new spintronic devices such as tunneling magneto-resistance junction, which can be used as a head of a hard-disc drive.



While today's electronic devices are based on the transfer of electrical charge between two materials, a potential alternative, spintronic devices, would also use the magnetic moment, or spin, of electrons in addition to their charge and would therefore be more efficient for sending or storing information as an electric signal. The research, published Sept. 21, was led by Jacobo Santamaria of Universidad Complutense de Madrid. Funding was provided by the Spanish Ministry of Science and Innovation. Work at ORNL was supported by DOE's Office of Basic Energy Sciences.

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**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **DOE/Oak Ridge National Laboratory**.

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**Journal Reference:**

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<http://www.sciencedaily.com/releases/2010/10/101018151300.htm>

## Mystery of Italy's Mount Etna Explained?



*Mt. Etna. The geophysicist Dr Wouter Schellart has developed the first dynamic model to explain the mystery of the largest and most fascinating volcano in Europe, Mount Etna. (Credit: iStockphoto/Domenico Pellegriti) ScienceDaily (Oct. 18, 2010) — Geophysicist Dr Wouter Schellart has developed the first dynamic model to explain the mystery of the largest and most fascinating volcano in Europe, Italy's Mount Etna on the island of Sicily.*

Dr Schellart's results from fluid dynamic models provide an alternative explanation for the existence of Mount Etna, its geological environment and evolution, as well as volcanism in the surrounding region. His theory suggests that Mount Etna is not directly the result of tectonic plate boundary activity, but that it resulted from decompression melting of upper mantle material flowing around the nearby edge of the Ionian slab that is slowly sinking into the Earth's mantle.

"Most volcanism on Earth occurs at plate boundaries in places where tectonic plates move apart (e.g. Iceland) and in places where tectonic plates come together with one plate diving (subducting) below the other plate into the mantle (e.g. Pacific ring of fire)," Dr Schellart said. "For the latter scenario, the volcanoes form directly above the subducted plate."

However, Dr Schellart said some volcanism, appropriately named intraplate volcanism, occurs far from plate boundaries and its origin is more controversial.

"The chemistry of the volcanic rocks from Mount Etna and the nearby Iblean volcanics in Sicily and in the surrounding seas indicate that they are intraplate volcanics. Interestingly, the volcanics are located within a few hundred kilometres of, but are laterally offset from, the Calabrian subduction zone plate boundary, where the African plate sinks below the Eurasian plate," Dr Schellart said.

"This suggests that the volcanics are somehow related to the Calabrian subduction zone."

"New modelling of subduction and mantle flow confirms this, showing that backward sinking of the African plate at the Calabrian subduction zone induced flow around the southern edge of the subducted plate and upward below Sicily," he said.

"The upward flow induced decompression melting of upper mantle material and these melts extruded at the surface in Sicily, forming Mount Etna and the Iblean volcanics," Dr Schellart said.



Until now there had been many explanations for Mount Etna and that of the surrounding volcanics, but none had been able to explain the timing, origin and dynamics of the activity.

"That's why Mount Etna has remained a mystery for so long," Dr Schellart said.

"The new research provides a dynamic explanation and completes the puzzle," he said Mount Etna is one of the most active volcanoes in the world and is in an almost constant state of activity. The most recent ash explosion occurred in August of this year, producing an ash plume that rose 800 meters above the crater edge. The research was recently published in the journal *Geology*.

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Monash University**.

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DOI: [10.1130/G31037.1](https://doi.org/10.1130/G31037.1)

<http://www.sciencedaily.com/releases/2010/10/101007092826.htm>

## Don't Blame Dairy Cows for (Greenhouse) Gas Emissions, New Study Shows

*A new study by the University of Arkansas and Michigan Tech shows that the dairy industry -- including this Jersey cow -- is responsible for only about 2 percent of all US greenhouse gas emissions. (Credit: Photo by Stephen Kennedy, courtesy of the Innovation Center for the US Dairy)*



ScienceDaily (Oct. 19, 2010) — Forget all the tacky jokes about cow flatulence causing climate change. A new study reports that the dairy industry is responsible for only about 2.0 percent of all US greenhouse gas emissions.

The study, led by the University of Arkansas in association with Michigan Technological

University, measures the carbon footprint of a gallon of fluid milk from farm to table and uses 2007 and 2008 data from more than 500 dairy farms and 50 dairy processors, as well as data from more than 210,000 round trips transporting milk from farm to processing plant. It was commissioned by the Innovation Center for the US Dairy, an industry-wide group.

The University of Arkansas addressed carbon emissions from the dairy to the milk in your cereal bowl. The Michigan Tech group looked further upstream. "We focused on the carbon footprint of the feed crops," said chemical engineering professor David Shonnard, director of the Sustainable Futures Institute. "Animal feed is a major contributor to carbon emissions." Using US Department of Agriculture data, Shonnard's team, including PhD student Felix Adom and four undergraduates (Ashely Maes, Charles Workman, Zachary Bergmann and Lilian Talla), analyzed the impact of variables ranging from fertilizer and herbicides to harvesting and transportation. "We also looked at a Michigan feed mill, where grain gets combined with any of over a hundred different additives," he said.

The team concluded that the cumulative total emission of greenhouse gases associated with all fluid milk consumed in the US was approximately 35 million metric tons in 2007. While the emissions are lower than sometimes reported, there is still room for improvement for dairy farms and businesses of all kinds, the study concluded. In particular, manure management, feed production and enteric methane (cow gas) were cited as areas that are ripe for innovation on farms. Energy management provides the greatest opportunity in the processing, transportation and retail segments.

The project has also raised other dairy-related issues that Shonnard's group is investigating. They are studying the eutrophication of water -- what happens when nutrients such as manure and fertilizers get into surface water, causing an overbloom of algae that sucks oxygen from the water and kills fish. The team is also investigating water consumption and land use in the dairy industry. "Growing crops is becoming more productive all the time, and we may be able to use less land to satisfy demand," Shonnard said.

### Story Source:

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Michigan Technological University**. The original article was written by Marcia Goodrich.

<http://www.sciencedaily.com/releases/2010/10/101018163743.htm>

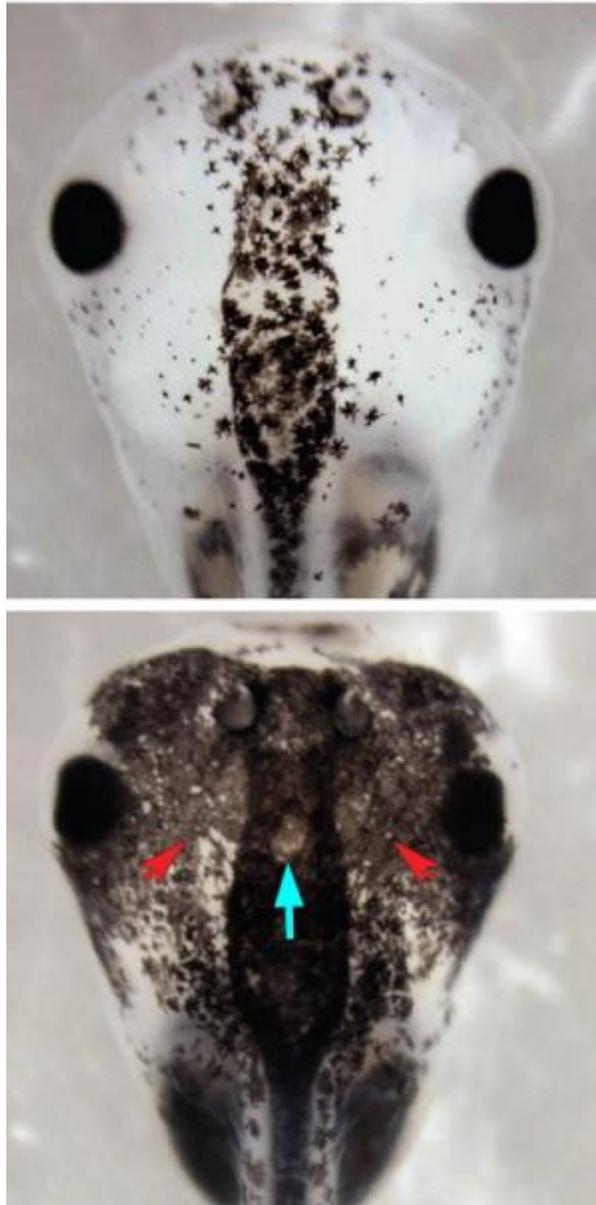
## Bioelectrical Signals Turn Stem Cells' Progeny Cancerous; Newly Discovered 'Instructor Cells' Can Deliver Deadly Directions

*An electrical switch for melanoma: biologists at Tufts University have discovered that a change in membrane voltage in newly identified "instructor cells" can cause stem cells' descendants to trigger melanoma-like growth in pigment cells (melanocytes). Hyperpigmentation can be seen in the treated tadpole embryo (B, red arrows), but not in the control embryo (A). The pigment cells not only grew in greater numbers but also formed long, branch-like shapes and invaded neural tissues, blood vessels and gut in a pattern typical of metastasis. Discovery of this novel bioelectric signal and cell type could aid in the prevention and treatment of diseases like cancer and vitiligo as well as birth defects. Tufts biologists manipulated the electrical properties of a special, sparse cell population present throughout the embryo by using the common anti-parasitic drug ivermectin to open the glycine gated chloride channel (GlyCl). The GlyCl channel is one of the many ion channels that control cellular membrane voltage and is a marker of this unique "instructor cell" population. Changing the chloride ion level to hyperpolarize or depolarize the cells in turn triggered abnormal growth in distant pigment cells derived from the neural crest stem cells. (Credit: Photo courtesy of Michael Levin-Tufts University)*

ScienceDaily (Oct. 19, 2010) — Biologists at Tufts University School of Arts and Sciences have discovered that a change in membrane voltage in newly identified "instructor cells" can cause stem cells' descendants to trigger melanoma-like growth in pigment cells. The Tufts team also found that this metastatic transformation is due to changes in serotonin transport. The discovery could aid in the prevention and treatment of diseases like cancer and vitiligo as well as birth defects.

The research is reported in the Oct. 19, 2010, issue of *Disease Models and Mechanisms*.

"Discovering this novel bioelectric signal and new cell type could be very important in efforts to understand the mechanisms that coordinate stem cell function within the host organism and prevent tumor growth. Ultimately it could enable us to guide cell behaviors toward regenerative medicine applications," said research leader and senior author Michael Levin, Ph.D., professor of biology and director of the Center for Regenerative and Developmental Biology at Tufts.



Co-authors on the paper were Tufts Postdoctoral Associate Douglas Blackiston, Research Associate Professor Dany S. Adams, Research Associate Joan M. Lemire and doctoral student Maria Lobikin.

Misregulation of stem cells is a known factor in cancers and birth defects. Recent studies have shown that stem cells exhibit unique electrophysiological profiles and that ionic currents controlled by ion channel proteins play important roles during stem cell differentiation. However, while many genetic and biochemical signaling pathways play a part in regulating the interplay between cells and the host organism, the role of bioelectric signals remains poorly understood, particularly when looking beyond artificial cultures to entire living organisms.

"One of the things we need to know is how cells know what to do in order to participate in the complex pattern of a host organism. The body normally tells cells 'don't become cancerous and go off on your own; instead, participate in keeping up the normal shape of all the tissues and organs, as individual cells age and die,'" said Levin.

To determine how changes in membrane voltage regulate cell behavior in vivo, the Tufts researchers looked at a group of stem cells in *Xenopus laevis* frog embryos called the neural crest. Neural crest stem cells migrate throughout the body in vertebrates, including humans. They give rise to many cell types, including pigmentation cells called melanocytes, and contribute to structures such as the heart, face and skin. Congenital malformations of the neural crest are known to affect their descendent cells and cause birth defects.

The Tufts biologists manipulated the electrical properties of a special, sparse cell population present throughout the embryo by using the common anti-parasitic drug ivermectin to open the glycine gated chloride channel (GlyCl). The GlyCl channel is one of the many ion channels that control cellular membrane voltage and is a marker of this unique "instructor cell" population. Changing the chloride ion level to hyperpolarize or depolarize the cells in turn triggered abnormal growth in distant melanocytes derived from the neural crest. These pigment cells not only grew in greater numbers but also formed long, branch-like shapes and thoroughly invaded neural tissues, blood vessels and gut. This pattern is typical of metastasis.

The ability of these GlyCl-expressing cells to radically change the shape, position, and quantity of a different cell type (melanocytes) revealed a new and potentially highly important cell type -- an instructor capability that can change the behavior of other cells a considerable distance away.

The researchers achieved similar results when they used a variety of different methods to manipulate transmembrane potential. Therefore, they concluded that the impact was triggered by the voltage change itself and was not intrinsically dependant on ivermectin, chloride flow or the GlyCl channel.

Testing of human epidermal melanocytes in a depolarizing medium also showed a shape change similar to that found in the *Xenopus* tadpoles.

The researchers also addressed the question of how cells sensed depolarization and converted this biophysical signal into changes in distant cells' behavior. After testing three potential mechanisms, they found that transport of serotonin (a neurotransmitter that can be modulated to regulate mood, appetite and other functions) across the cell surface was the likely messenger.

The Tufts researchers note that analysis of other ion channels might reveal other instructor cells that can signal and change the behavior of various important cells in the body. Learning to identify and manipulate such cell types may reveal additional roles for ion flows and establish a new model for control of cell behavior in regenerative medicine and oncology.

Levin and his colleagues are already pursuing avenues for early, non-invasive cancer detection using voltage-sensitive dyes and exploring techniques to normalize cancer by repolarizing abnormal cells and instructor cells.

The research was funded by the National Institutes of Health, Department of Defense, Forsyth Institute and NIH- National Institute of Dental and Craniofacial Research.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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#### Story Source:



The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Tufts University**, via EurekAlert!, a service of AAAS.

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**Journal Reference:**

1. Douglas Blackiston, Dany S. Adams, Joan M. Lemire, Maria Lobikin and Michael Levin. **Transmembrane potential of GlyCl-expressing instructor cells induces a neoplastic-like conversion of melanocytes via a serotonergic pathway.** *Disease Models & Mechanisms*, 2010; (in press) [[link](#)]

<http://www.sciencedaily.com/releases/2010/10/101019082346.htm>

## Rotten Experiments Help to Create Picture of Our Early Ancestors



*This image shows the remains of a hagfish after 20 days of decay. Only the head skeleton, notochord and parts of the liver are left. (Credit: University of Leicester)*

ScienceDaily (Oct. 12, 2010) — An innovative experiment at the University of Leicester that involved studying rotting fish has helped to create a clearer picture of what our early ancestors would have looked like. The scientists wanted to examine the decaying process in order to understand the decomposition of soft-body parts in fish. This in turn will help them reconstruct an image of creatures that existed 500 million years ago. Their findings have been published Oct. 13 in the journal *Proceedings of the Royal Society B*. The work was funded by the Natural Environment Research Council (NERC).

The researchers, from the Department of Geology at the University of Leicester, studied the way primitive fish, such as hagfishes and lampreys, decompose to gain an impression of our early ancestry.

The team at Leicester (Rob Sansom, Sarah Gabbott and Mark Purnell) explain: "Our earliest fish-like relatives left fossil remains which have the potential to show us how the group to which we belong evolved from worm-like relatives. But there is a major problem -- people are familiar with bones, and teeth as fossils but do not perhaps realise that before these inventions our ancestors consisted of entirely soft bodied creatures. Eyes, organs, guts and muscles all decompose very quickly after death, and as any forensic scientist knows recognising rotted anatomy is difficult.

"Fossils from 500 million years ago provide our only direct evidence of how our earliest vertebrate ancestors evolved from the simple worm-like animals."

The fossils from the early phase of vertebrate evolution are very rare because being completely soft-bodied they normally rotted away completely after death leaving nothing behind. But very occasionally their remains became preserved as fossils giving us a tantalising glimpse of our early vertebrate relatives.

However, as Rob Sansom explains correctly reading and reconstructing what our ancestors looked like from these semi-rotted remains is tricky. "Interpreting half-a-billion year old fossils is challenging enough in itself, but even more so when the remains comprise only the decayed soft parts which may look quite different to how they would have done in life."

Sarah Gabbott, one of the leaders of the study, admits that at first it may be difficult to see why spending hundreds of hours studying the stinking carcasses of rotting fish helps us to unlock our evolutionary history, but she points out that the results have been critical to correctly reading fossils from this phase in our history. "In a way our experiments are similar to those going on at the infamous 'body farms' in the USA, where

human cadavers are left to decompose so that forensic scientists can determine time and cause of death. But, as palaeontologists we want to uncover what an animal which lived 500 million years ago looked like before it died."

"Our macabre experiments are grisly and smelly but they have revealed, for the first time, what characteristic vertebrate features look like when they are partially decomposed."

Rare fossilized fish-like fossils are recognised as being part of our evolutionary history because they possess characteristic anatomical features, such as a tail, eyes and the precursor of a backbone. Mark Purnell, explains further: "our experiments have provided us with a set of photofit-like images allowing us to decipher and correctly identify features in fossils. Our ability to flesh out what our earliest vertebrate ancestors looked like and correctly place them on the Tree of Life is critical to understanding whether our earliest relatives evolved in a burst of complexity or gradually over millions of years"

These new results show that some of the characteristic anatomical features of early vertebrate fossils have been badly affected by decomposition, and in some cases may have rotted away completely. Knowing how decomposition affected the fossils means our reconstructions of our earliest ancestors will be more scientifically accurate.

**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **University of Leicester**, via **EurekAlert!**, a service of AAAS.

**Journal Reference:**

1. R. S. Sansom, S. E. Gabbott, M. A. Purnell. **Decay of vertebrate characters in hagfish and lamprey (Cyclostomata) and the implications for the vertebrate fossil record.** *Proceedings of the Royal Society B: Biological Sciences*, 2010; DOI: [10.1098/rspb.2010.1641](https://doi.org/10.1098/rspb.2010.1641)

<http://www.sciencedaily.com/releases/2010/10/101012192133.htm>

## Parkinson's Disease Insights: Damage to Control Circuits in the Brain Responsible for Habits

ScienceDaily (Oct. 19, 2010) — An international collaboration led by academics at the University of Sheffield has shed new light into Parkinson's disease. The research could help with the development of cures or treatments in the future.

The collaboration, which was led by Professor Peter Redgrave from the University's Department of Psychology, suggests that many of the problems suffered by patients with Parkinson's disease -- difficulties in initiating actions, slow laboured movements and tremors -- can be understood in terms of damage to control circuits in the brain responsible for habits.

The analysis, which is published online and will appear in the November issue of *Nature Reviews Neuroscience*, has involved combining the experience of an international team of clinical experts to explain why, paradoxically, removal of part of the brain can help sufferers of Parkinson's disease regain smooth initiation of movements.

An important processing unit in the brain (the basal ganglia) is part of two behavioural control circuits -- habitual control, which directs our fast, stimulus-driven automatic, largely unconscious movements; and voluntary goal-directed control, which is driven by a conscious appreciation of the action's outcome. This means goal-directed movements are typically slower, require effort, and can only be done one at a time. Different regions of the basal ganglia are involved in goal-directed and habitual control. An important proposal in the *Nature Reviews Neuroscience* article is that Parkinson's disease is linked to a preferential loss of the neurotransmitter dopamine from the regions involved in habitual control.

Many of the symptoms of Parkinson's disease can therefore be understood in terms of a catastrophic loss of habits, which means patients have to rely on the goal-directed control system for everything they do. This idea can explain why their movements are slow, effortful and easily interrupted. For example, when approaching a narrow door or object, a patient with Parkinson's disease can suddenly freeze and find it difficult to start again. Under serial goal-directed control, (i.e. you can only think about doing one thing at a time), when the patient stops thinking about walking and starts to think about going through the door or avoiding the object, they stop walking.

The proposed analysis offers a further important insight into the symptoms of Parkinson's disease. At the level of the basal ganglia, the goal-directed and habitual control circuits are physically separated, but down-stream, they converge on shared motor systems (that is, we can do the same action either under goal-directed or habitual control). Numerous experiments show that the loss of dopamine from the basal ganglia increases inhibitory output from the habitual control circuits. Therefore, for a patient with Parkinson's disease to express goal-directed behaviour, they have to overcome the distorting inhibitory signals from the malfunctioning habitual control system. This provides a further reason for why patients find it so difficult to initiate and maintain actions and why their behaviour is so effortful and slow.

These ideas also offer a potential resolution of a continuing paradox in Parkinson's disease research -- why destruction of the parts of the basal ganglia responsible for habits can have such a beneficial effect on Parkinson's disease. Professor Redgrave and his team propose that removal of the distorting inhibitory output from habitual control circuits could make it easier for goal-directed behaviour to be expressed.

It is hoped this new interpretation of Parkinson's disease will help in the discovery of new cures and treatment in the future for the 120,000 people in the UK suffering with the disease. Firstly, by directing attention to what makes the habitual basal ganglia particularly vulnerable, and secondly to parts of the brain where goal-directed behaviour is being disrupted by dysfunctional signals from the circuits responsible for habits.

Neuroscientist Professor Peter Redgrave from the University of Sheffield's Department of Psychology, said: "We hope our analysis provides a better understanding of the link between normal and abnormal functioning in the basal ganglia. This is important because the better your understanding of normal function, the better the questions you can ask about its failings, which hopefully, will direct you towards more effective treatments."

**Editor's Note:** This article is not intended to provide medical advice, diagnosis or treatment.

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### Story Source:



The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **University of Sheffield**.

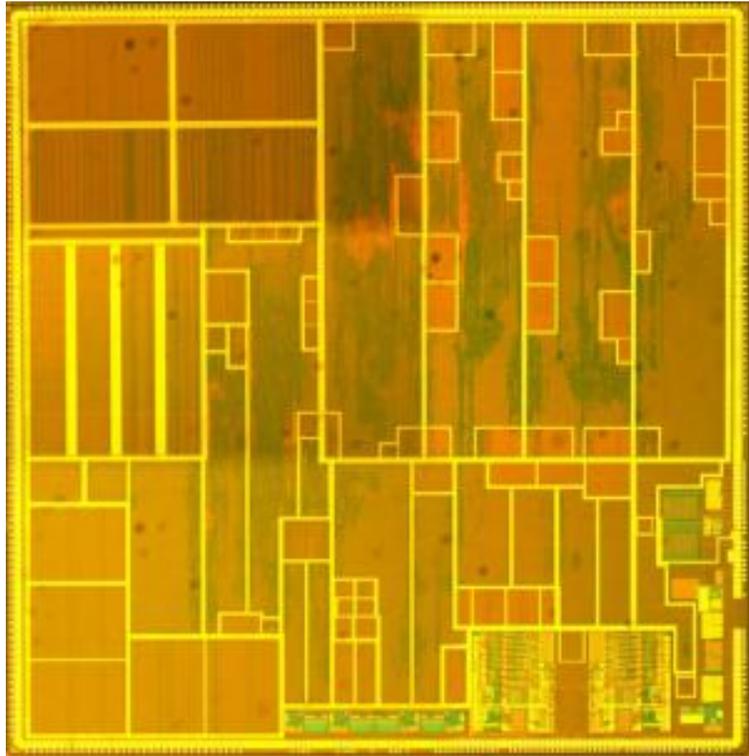
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1. Peter Redgrave, Manuel Rodriguez, Yoland Smith, Maria C. Rodriguez-Oroz, Stephane Lehericy, Hagai Bergman, Yves Agid, Mahlon R. DeLong, Jose A. Obeso. **Goal-directed and habitual control in the basal ganglia: implications for Parkinson's disease.** *Nature Reviews Neuroscience*, 2010; DOI: [10.1038/nrn2915](https://doi.org/10.1038/nrn2915)

<http://www.sciencedaily.com/releases/2010/10/101019121802.htm>

## 'Virtual Satellite Dish' Thanks to Lots of Simple Processors Working Together



*Image of the Van de Burgwal's chip. (Credit: Image courtesy of University of Twente)*

ScienceDaily (Oct. 18, 2010) — Satellite TV without having to set up a receiver dish. Digital radio on your mobile phone without your batteries quickly running flat. The advanced calculations needed for these future applications are made possible by a microchip with relatively simple processors that can interact and communicate flexibly. These are among the findings of research at the Centre for Telematics and Information Technology of the University of Twente carried out by Marcel van de Burgwal, who obtained his PhD on 15 October.

Soon it will be possible to receive satellite signals not only with a satellite dish, but also using stationary antennae arrays made up of grids of simple, fixed, almost flat antennae that can fit on the roof of a car, for example. The antennae then no longer need to be carefully aimed: the grid of antennae forms a 'virtual dish'. That is a great advantage, especially for mobile applications such as satellite TV on the move. The aiming of the virtual dish is actually carried out by the entire grid. It is comparable with the LOFAR project, in which countless simple antennae laid out on the heathland of Drenthe in the north east Netherlands together form a huge dish for radiotelescopy. This too calls for large numbers of calculations and fast communications.

### **Computing power replaces analogue components**

Conventional microprocessors are less suitable for these calculations, because they are highly overdimensioned and use large amounts of energy. The remedy is a combination of smaller, simple processors on a single microchip that can carry out tasks flexibly and be switched off when they are not needed. In this way a complete computer network can be constructed that takes up just a few square millimetres. To achieve this, Van de Burgwal makes use of an efficient infrastructure based on a miniature network, where a TV or radio receiver is defined by software instead of the classic coils and crystals. "Software-defined radio may seem much more complex, but we can pack so much computing power into the space taken up by, for example, a coil that it more than repays the effort," says Van de Burgwal.

### **Chameleon**



The same type of microchip also turns out to be suitable for a completely different application: digital radio reception on a smartphone, where the main criterion is minimizing energy use. In his doctoral thesis Van de Burgwal shows that major gains can also be made here by using new methods of communication between the different processors. The multi-processor chip that he uses is based on the Montium processor -- appropriately named after a chameleon -- that was developed at the University of Twente. The processor is being further developed and marketed by the spinoff business Recore Systems.

Marcel van de Burgwal carried out his research in the Computer Architecture for Embedded Systems group, which forms a part of the Centre for Telematics and Information Technology at the University of Twente.

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**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **University of Twente**.

<http://www.sciencedaily.com/releases/2010/10/101018112354.htm>

## Inhaling Nitric Oxide Eases Pain Crises in Sickle Cell Patients, Researchers Find



*Dr. C. Alvin Head is chairman of the Department of Anesthesiology at the Medical College of Georgia School of Medicine. (Credit: Phil Jones, Campus Photographer)*

ScienceDaily (Oct. 19, 2010) — Inhaling nitric oxide appears to safely and effectively reduce pain crises in adults with sickle cell disease, researchers report.

A study of 18 patients in Atlanta, Chicago and Detroit showed that the nine inhaling nitric oxide for four hours had better pain control than those receiving only the standard self-administered morphine, said Dr. C. Alvin Head, chairman of the Department of Anesthesiology at the Medical College of Georgia School of Medicine.

"This study shows that you can breathe the gas and have less pain, which is the major reason sickle cell patients are admitted to the hospital," said Head, corresponding author of the study published in the *American Journal of Hematology*.

A larger study will help define the optimal dose as well as timing and duration for the treatment, Head said. If findings continue to hold, he envisions sickle cell patients, much like asthmatics, having nitric oxide inhalers handy to forestall a full-blown pain crisis. The pain results when sickle cell patients' abnormally shaped hemoglobin impedes oxygen delivery.

"By the time you see a patient in the emergency room or the clinic, they have a significant amount of pain and you are always playing catch-up," Head said. "The idea would be to use this as early as possible."

While it's not certain how nitric oxide helps, Head has laboratory evidence and some early clinical indications that nitric oxide, which has a great affinity for hemoglobin, restores hemoglobin's natural shape and charge. The more normal negative charge helps cells repel each other, melts sticky polymers and may prevent new ones from forming. In fact, he suspects that one of nitric oxide's usual duties in the body is to help prevent clot formation.

"If you have pain relief without more narcotic then we must be attacking the problem," Head noted. The study participants receiving nitric oxide use slightly less morphine than the control group and continued to experience pain relief two hours after the therapy ended. No patients showed signs of nitric oxide toxicity.



Head suspects morphine will eventually be replaced by a mix of other drugs, such as nitric oxide, that address the pain's root cause.

He is planning human and animal studies to see if extremely low doses of nitric oxide during pregnancy also can improve delivery rates. "We think it will be productive so the mother has fewer crises, less stress, more blood flow to the placenta and an improved chance of a baby to be delivered," Head said.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Medical College of Georgia**. The original article was written by Toni Baker.

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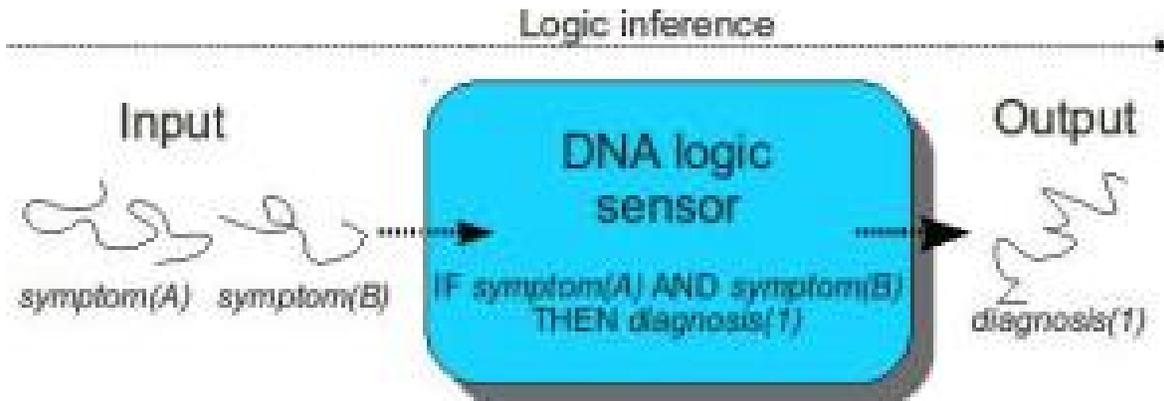
**Journal Reference:**

1. C. Alvin Head, Paul Swerdlow, William A. McDade, Ratan Mani Joshi, Tohru Ikuta, Melanie L. Cooper, James R. Eckman. **Beneficial effects of nitric oxide breathing in adult patients with sickle cell crisis.** *American Journal of Hematology*, 2010; 85 (10): 800 DOI: [10.1002/ajh.21832](https://doi.org/10.1002/ajh.21832)

<http://www.sciencedaily.com/releases/2010/10/101019121758.htm>



## New Biological Sensor Detects and Analyses DNA Sequences



*Schematic of the new system. (Credit: FIUPM)*

ScienceDaily (Oct. 19, 2010) — The Universidad Politécnica de Madrid's Artificial Intelligence Group (LIA), based at the Facultad de Informática, has created a new DNA-based biological sensor that has potential applications in the field of genetic diagnostics. The basic sensor design was presented at the 2010 Conference on Unconventional Computation.

The LIA group has submitted a patent application for the design of this logical DNA sensor. These sensors are able to represent logical implications (or IF-THEN rules), like, for example, IF symptom 1 and symptom 2 are present, THEN the disease is A, or IF the disease is B, THEN symptoms 2 and 3 must be present. The sensors are able to use these logical rules to autonomously run logical inference processes on the genetic input signals and reach accurate diagnoses.

Using these intelligent DNA sensors as basic building blocks, the aim is to develop *in vitro* systems capable of autonomously detecting a set of input symptoms and output a diagnosis or release the right drug.

These biological sensors (built with DNA to process DNA) are considered bionanotechnological devices and are part of a discipline called DNA computing or biomolecular computing. This discipline aims to build and program devices manufactured with biomolecules, such as, for example, DNA strands to process information likewise encoded in other biomolecules.

In short, there is a need to develop and manufacture biological sensors capable of precisely detecting complex combinations of genetic signals and autonomously issuing the respective diagnoses. The bionanotechnological devices developed by the UPM's LIA group at the Facultad de Informática are a response to this need.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*

### Story Source:

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Facultad de Informática de la Universidad Politécnica de Madrid**, via [AlphaGalileo](#).

<http://www.sciencedaily.com/releases/2010/10/101019084615.htm>

## Genomic Comparison of Ocean Microbes Reveals East-West Divide in Populations



To obtain microbe samples, scientists on the R/V Kilo Moana oceanographic research ship lower a rosette holding 24 bottles that capture samples at different ocean depths in the Pacific Ocean. (Credit: Photo by Maureen Coleman)

ScienceDaily (Oct. 11, 2010) — Much as an anthropologist can study populations of people to learn about their physical attributes, their environs and social structures, some marine microbiologists read the genome of microbes to glean information about the microbes themselves, their environments and lifestyles.

Using a relatively new methodology called comparative population genomics, these scientists compare the entire genomes of different populations of the same microbe to see which genes are "housekeeping" or core genes essential to all populations and which are population-specific. Scientists are able to read a genome and translate the genes into proteins that serve particular functions. Population-specific genes sometimes tell a very clear story about the environment, for instance temperature and the availability of light and particular elements, and over time, they can point to the microbes' evolutionary adaptation to changes in the ecosystem. Occasionally, as was the case with recent research at MIT, the population-specific genes reveal this information with crystal clarity, even providing unmistakable clues about lifestyle.

Professor Sallie (Penny) W. Chisholm of MIT's Department of Civil and Environmental Engineering (CEE) and former doctoral student Maureen Coleman compared the genetic makeup of two populations of the same oceanic photosynthetic bacterium, *Prochlorococcus*, one living in the Atlantic Ocean and one in the Pacific. They found that although a continent separates the populations, they differ significantly in only one respect: those in the Atlantic have many more genes specifically related to the scavenging of phosphorus, an essential element for these microbes. And just as the variations in the beaks of Darwin's finches were evolutionary adaptations related to food availability, so too are the variations in the *Prochlorococcus* genes related to phosphorous gathering. Both are examples of a powerful evolutionary force at work.

"We expected to see some difference in the genes related to phosphorous, because the Atlantic Ocean has an order of magnitude lower concentration of phosphorus than the Pacific, so Atlantic populations of *Prochlorococcus* carry many more genes involved in extracting phosphorus from the seawater. They need

more creative ways of gathering it. But we didn't expect it to be the only difference," said Chisholm. "This indicates that phosphorus availability is the dominant selective force in defining these populations." The researchers also noted that the microbes in the Atlantic Ocean had increased numbers of phosphorus-related genes that helped them neutralize arsenic, an element they sometimes take up by mistake when they're scavenging for phosphorus. This finding "buttresses the assertion" that this is the result of a strong selective process, Chisholm said.

"We're really diagnosing the ecosystem using a specific species of microbe as a reporter," said Chisholm. "We're letting the cells tell us what they have to deal with in their environment."

She and Coleman also compared the genomes of two populations of a neighboring bacterium, *Pelagibacter*, and found that genes related to phosphorus gathering in that bacterium appear in far greater numbers in the Atlantic Ocean population, but with a twist. These microbes have a somewhat different repertoire of phosphorus-related genes, suggesting subtle differences between these two microbial groups with respect to how they scavenge phosphorus. This could reflect an adaptive behavior known as "niche partitioning," which allows cells sharing a microenvironment to apportion resources according to a cell's "lifestyle" rather than all competing for the same element or same form of that element.

To obtain these findings, which were published in the online Early Edition of the *Proceedings of the National Academy of Sciences* the week of Oct. 11, the two scientists used the complete genomes of 13 strains of lab-cultured *Prochlorococcus* and *Pelagibacter* as reference genes, and compared these with the genes of well-documented wild microbe populations gathered at long-term oceanographic study stations near Bermuda (BATS) and Hawaii (HOTS). The work was funded by the Gordon and Betty Moore Foundation, the National Science Foundation and the U.S. Department of Energy.

The next step in this research is to make similar studies at different depths and locations to study the effects of temperature and chemical gradients on the genomes of microbial populations.

"How fast marine microbes adapt to environmental change is a big unknown," said Coleman, who is now a postdoctoral associate at Caltech. "One way to address this is to sample the population genomes over time, with parallel environmental monitoring. We might then be able to catch evolution in action. Long term study sites like HOT and BATS are crucial for this effort."

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**Story Source:**

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **Massachusetts Institute of Technology**. The original article was written by Denise Brehm, Civil and Environmental Engineering.

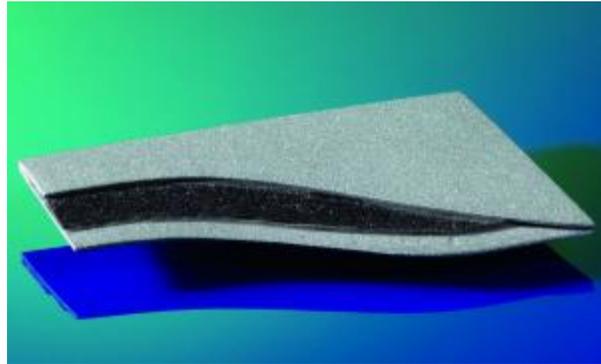
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<http://www.sciencedaily.com/releases/2010/10/101011173551.htm>

## Plastic Monitors Itself



*The new composite material is a blend of synthetic and metal that has sensory properties. (Credit: © Fraunhofer IFAM)*

ScienceDaily (Oct. 18, 2010) — A new polymer-metal material that has sensory properties makes it possible to produce plastic component parts that monitor themselves. This material can be combined with various others and used in a variety of different ways.

Researchers at Fraunhofer will be unveiling this polymer-metal composite at the ELECTRONICA 2010 fair (Nov. 9-12 in Munich, Germany).

When the storm winds blow, wind turbines have to show what they can stand up to. The wind blows hard against mills with the force of tons as the tips of the blades plow through the air at more than 200 kilometers per hour. But natural forces not only tear at wind turbines; machine components made of plastic or airplane wings must with stand substantial loads as well.

These days, we normally use sensors to measure whether these components are strained beyond capacity, and it requires a lot of effort to install them into the component parts or glue them onto their surface. Because these monitoring sensors usually only register tensile or pressure loads in a small range, we link several individual sensors to create a single network if we want to record greater areas on the component. Researchers at Fraunhofer Institute for Manufacturing Technology and Applied Material Research (IFAM) in Bremen, Germany, are now making it measurably easier to inspect these large-scale components because they have come up with a new composite material especially for components made of plastic. It has sensory properties that can be directly worked or installed into a synthetic component when it is manufactured. This material also meets design requirements.

This new composite material is a blend of plastic and metal better known as polymer-metal composite material. There is a wide range of plastics that are suited as a matrix material for manufacturing this composite, which means that it can easily be tailor-made for a whole series of purposes. But it also has other advantages. First of all, due to its synthetic character, this material can be easily processed. Beyond this, it is lightweight and conducts current and heat very well due to the high proportion of metal in it. What is especially fascinating about this material is the fact that it can be processed with conventional machines used in plastics manufacturing -- among other things, in extruders or in injection-molding machines in which the heated liquid plastic is injected into a form where it hardens immediately. Finally, this material can be laminated as a type of mat on large surfaces. In the future, researchers want to use nozzles to apply this conducting plastic as a viscous liquid to geometrically complex surfaces.

This polymer-metal composite material has its high proportion of metal and a special mixing technique to thank for its excellent sensory properties. As Arne Haberkorn, the project manager for composite developments at the Fraunhofer Institute for Manufacturing Technology and Applied Material Research, points out, "we reach a metallic filling proportion of as much as 90 percent in weight in this composite when needed," with the composite's electrical resistance changing if there are loads during operation. The signals can be drawn off with cables on the component part and passed them onto a measuring instrument for analysis.



It was a special challenge for Haberkorn and his colleagues to come up with a technique for evenly processing different metallic substances in liquid plastic. This new technique functions with a whole range of synthetic materials, for instance with polypropylene just as well as with polyamide. Haberkorn is happy to say "this means we can combine our polymer-metal composite material with various synthetics and process them into a wide range of component parts. That includes not only solid and heat-resistant, but also soft-flexible workpieces." Researchers have used various prototypes to demonstrate that the method functions and are now searching for potential industrial users.

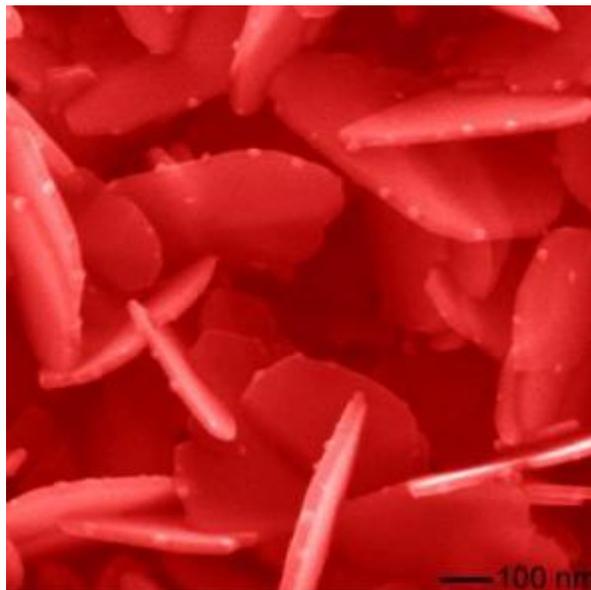
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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Fraunhofer-Gesellschaft**.

<http://www.sciencedaily.com/releases/2010/10/101018151254.htm>

## Breakthrough in Nanocrystals Growth



*This image shows nanoparticles growing. (Credit: Image courtesy of Wenge Yang)*

ScienceDaily (Oct. 19, 2010) — For the first time, scientists have been able to watch nanoparticles grow from the earliest stages of their formation. Nanoparticles are the foundation of nanotechnology and their performance depends on their structure, composition, and size. Researchers will now be able to develop ways to control conditions under which they are grown. The breakthrough will affect a wide range of applications including solar-cell technology and chemical and biological sensors.

The research is published in *Nano Letters*.

As coauthor Wenge Yang of the Carnegie Institution's Geophysical Laboratory explained: "It's been very difficult to watch these tiny particles be born and grow in the past because traditional techniques require that the sample be in a vacuum and many nanoparticles are grown in a metal-conducting liquid. So we have not been able to see how different conditions affect the particles, much less understand how we can tweak the conditions to get a desired effect."

These researchers work at the Center for Nanoscale Materials and the Advanced Photon Source (APS)-both operated by Argonne National Laboratory-and the High Pressure Synergetic Consortium (HPSynC), a program jointly run by the Geophysical Laboratory and Argonne. The scientists used high-energy X-rays from the APS to carry out diffraction studies that enabled them to gain information on the crystal structure of the materials. Thanks to the highly brilliant and high penetration of this X-ray source-the largest of its kind in the US-the researchers were able to watch the crystals grow from the beginning of their lives. The atoms scatter very short wavelength X-rays and the resulting diffraction pattern reveals the structure of these unusual particles. Quite often the chemical reaction occurs in a very short time and then evolves. The scientists used highly focused high-energy X-rays and a fast area detector, the key components to make this investigation possible. This is the first time-resolved study of the evolution of nanoparticles from the time they are born. HPSynC, is also a part of the Energy Frontier for Research in Extreme Environments (EFree) Center, an Energy Frontier Research Center supported at Carnegie by DOE-BES. One of the missions of this center is to harness new synchrotron radiation techniques for in situ studies of materials structure and dynamics in extreme conditions and thereby to understand and produce new energy materials.

"This study shows the promise of new techniques for probing crystal growth in real time. Our ultimate goal is to use these new methods to track chemical reactions as they occur under a variety of conditions, including variable pressures and temperatures, and to use that knowledge to design and make new materials for energy



applications. This is a major thrust area of the HPSynC program that we have launched in partnership with Argonne National Laboratory," remarked Russell Hemley, the director of Geophysical Laboratory.

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **Carnegie Institution**.

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**Journal Reference:**

1. Yugang Sun, Yang Ren, Dean R. Haeffner, Jonathan D. Almer, Lin Wang, Wenge Yang, Tu T. Truong. **Nanophase Evolution at Semiconductor/Electrolyte Interface in Situ Probed by Time-Resolved High-Energy Synchrotron X-ray Diffraction.** *Nano Letters*, 2010; 10 (9): 3747 DOI: [10.1021/nl102458k](https://doi.org/10.1021/nl102458k)

<http://www.sciencedaily.com/releases/2010/10/101018163108.htm>

## Eyetracker Warns Against Momentary Driver Drowsiness

*The Integrated Eyetracker developed by the Fraunhofer IDMT permits contact-free and completely calibration-free 3-D measurement of a person's line of vision. (Credit: Copyright Fraunhofer IDMT)*

ScienceDaily (Oct. 19, 2010) — Car drivers must be able to react quickly to hazards on the road at all times. Dashboard-mounted cameras help keep drivers alert. At the VISION trade fair in Stuttgart, researchers are presenting this system from November 9-11, 2010.

Those who do a lot of driving know how tiring long car trips and night driving can be. And a simple fraction of a second can decide the

difference between life and death. According to the German Road Safety Council e.V. (DVR), one in four highway traffic fatalities is the result of momentary driver drowsiness. Researchers at the Fraunhofer Institute for Digital Media Technology IDMT in Ilmenau, Germany, have developed an assistant system that tracks a driver's eye movements and issues a warning before the driver has an opportunity to nod off to sleep.

The special feature of the Eyetracker is that it can be installed in any model of car. There is no need for a complicated calibration of the cameras. "With conventional systems, every person whose line of vision is to be monitored has to complete more or less time-consuming preparations. Because every head, every face, every pair of eyes is different," notes Prof. Husar of the IDMT.

There is also another benefit: The system does not require a PC or a laptop. "What we have developed is a small modular system with its own hardware and programs on board, so that the line of vision is computed directly within the camera itself. Since the Eyetracker is fitted with at least two cameras that record images stereoscopically -- meaning in three dimensions -- the system can easily identify the spatial position of the pupil and the line of vision," according to Husar. The information is fed out through a standard interface. The information is stored in a standard interface (USB, CAN). This way, the Eyetracker can be connected directly to the car's trip computer.

If the camera modules detect that the eye is closed for longer than a user-defined interval, it sounds an alarm. When used as a driver-assistance system, there can be four or even six cameras keeping watch over the driver's eyes. The cameras evaluate up to 200 images per second to identify the line of vision, even when a driver's head moves to the left or right. Yet the Eyetracker is only roughly half the size of a matchbox and practically undetected when mounted behind the sun visor and in the dashboard. The tiny lenses are just three to four millimeters in diameter.

There are a host of applications for the Eyetracker. In medicine, the camera system can assist with eye operations by registering a patient's every eye movement. With this technology, players of computer games can also look around themselves, without requiring a joystick to change their viewing direction. It is also a valuable tool for marketing and advertising researchers with an interest in determining which parts of a poster or advertising spot receive longer attention from their viewers.

**Editor's Note:** *This article is not intended to provide medical advice, diagnosis or treatment.*



### Story Source:

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Fraunhofer-Gesellschaft**.

<http://www.sciencedaily.com/releases/2010/10/101013083307.htm>

## More Than a Century After the Gold Rush, Mining an Historical Park's Lichen Diversity



Example of a lichen -- a symbiosis between a fungus and an alga. (Credit: University of Graz)

ScienceDaily (Oct. 19, 2010) — Alaska may be staking out yet another claim to a natural treasure, but one which does not immediately meet the eye. In article appearing in October in the journal *The Bryologist*, a team of researchers from Austria, Norway, Spain and the United States reports the highest diversity of lichens found anywhere on the North American continent from the Klondike Gold Rush National Historical Park (KLG0).

Located at the headwaters of the longest fjord in southeast Alaska, an area of only 13,000 acres (53 square kilometers) harbors the highest number of lichens and associated fungi ever found in an area of comparable size: 766 species in two slivers of land along the 1898-99 Gold Rush trails out of Skagway and Dyea, Alaska. While lichen surveys have been completed for only a few national parks in North America, the Klondike survey, funded by the U.S. National Park Service, is notable for edging out some much larger National Parks, including 300 more species than either Yellowstone, Glacier and Great Smoky Mountains National Parks. Indeed, the Klondike study has the ninth highest number of species of any lichen survey ever conducted worldwide in an area under 10,000 square kilometers.

Perhaps most surprisingly, however, fully seventy-five species -- nearly 10% of all species found -- are candidates for being new to science because they do not match any known species in a global literature review. Among the notable finds, the authors discovered a new genus of lichens with similarities to rock-dwelling genus *Steinera* in New Zealand and subantarctic islands. They name the genus *Steineropsis*, meaning 'looking like *Steinera*'. The authors describe another species, *Coccotrema hahriae*, in honor of Meg Hahr, the former natural resources program manager of Klondike Gold Rush National Historical Park, who passed away last year. Altogether five new species for science are described in the current paper.

"This is like uncovering a biodiversity hotspot on the order of some of the lost forests in New Guinea or Mozambique," says the principal investigator, Toby Spribille, a Montana native and current graduate student at the University of Graz, Austria.

Spribille, together with his collaborators from the Spanish National Research Council, Madrid, and the University of Bergen, Norway, also highlight the significance of finding a biodiversity hotspot at high latitudes. "It's generally assumed biodiversity declines as you move towards the poles, but this has so far not been the case for lichens." He notes that lichens, which are a symbiosis between a fungus and an alga, have



been shown to reach optimum growth conditions at cool temperatures and thus could be expected to peak in diversity in cool climates.

The Klondike study also includes a first-ever overview of top lichen biodiversity studies worldwide. This showed that all of the other top lichen inventories in the world to date have come from middle to high latitudes, unlike in many other organism groups, in which the highest diversity is typically in the tropics. "This is important information to tie into climate change research," says Spribille. "The high latitudes are where the warming in the next century is expected to be the greatest, and while single species like the polar bear are considered threatened by the loss of arctic habitats, climate change is not usually getting translated into potential effects on large numbers of species." This view may begin to change, he predicts, as scientists discover that peak biodiversity for groups such as lichens may historically reside in the cool, damp forests and tundra of the north.

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**Story Source:**

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by **Karl-Franzens-Universität Graz**, via AlphaGalileo.

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**Journal Reference:**

1. Toby Spribille, Sergio Pérez-Ortega, Tor Tønsberg, and Dave Schirokauer. **Lichens and lichenicolous fungi of the Klondike Gold Rush National Historic Park, Alaska, in a global biodiversity context.** *The Bryologist*, 2010; 113 (3): 439-515 DOI: [10.1639/0007-2745-113.3.439](https://doi.org/10.1639/0007-2745-113.3.439)

<http://www.sciencedaily.com/releases/2010/10/101018074534.htm>

## Plastics and Nanoparticles -- The Perfect Combination



*When combined with plastics, these surface-modified carbon nanotubes can, for example, improve an aircraft's protection against lightning strikes. (Credit: © Fraunhofer IFAM)*

ScienceDaily (Oct. 14, 2010) — These days, plastic components are vital to many fields of industry -- lightweight construction, automobile manufacturing and electrical engineering, to name but a few. Now researchers have found ingenious ways to combine plastics with nanoparticles and endow them with new properties. Thanks to these innovative materials, aircraft could in future be better protected against lightning strikes.

Picture the scene: Pitch-black clouds gathering on the horizon, an aircraft winging its way towards the storm ... and suddenly a flash of white-hot lightning splits the sky. It is by no means a rare occurrence for aircraft to have to pass through bad weather fronts, but when they do, there is always one major danger -- lightning. Naturally, aircraft manufacturers do everything they can to protect their machines against strikes, but even aircraft made of aluminum do not always escape entirely unscathed. And when polymer components -- usually carbon fiber reinforced plastics (CFRPs) -- are incorporated into the design as a weight-saving measure, the situation becomes even more problematic, because they do not conduct electrical current as well as aluminum.

At the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM in Bremen, researchers have now developed a process for manufacturing new materials that should afford aircraft better protection against lightning strikes. They have been focusing on the unique material properties of carbon nanotubes (CNTs). CNTs are among the stiffest and strongest fibers known, and have particularly high electrical conductivity. In order to transfer their properties to CFRPs, the scientists have been combining these nanoparticles with plastics. "By mixing nanoparticles with plastics, we've been able to significantly enhance the material properties of the latter," states Dr. Uwe Lommatzsch, project manager at the IFAM. To give just two examples, CNTs are being used to optimize the electrical conductivity of plastics, and their heat dissipation properties are likewise being improved by the addition of metal particles.

The trick is in the mixing process, says Lommatzsch: "The micro- or nanoparticles must be highly homogeneous, and sometimes very closely bound to the polymer." To do this, the scientists employ plasma technology. They use an atmospheric plasma to alter the surface of the particles in such a way that they can be more readily chemically bound with the polymer. A pulsed discharge in a reaction chamber creates a reactive gas. Lommatzsch's colleague, Dr. Jörg Ihde, explains: "We spray the particles -- i.e. the nanotubes -- into this atmospheric plasma." They immediately fall into the selected solvent, which can then be used to further process the polymer. The whole procedure takes just a few seconds -- a huge advantage over the old method, in which CNTs were generally prepared in an acid bath using a wet chemical process. That took several hours or days, required considerably more chemicals, and generated significantly more waste.

In addition to improved carbon fiber reinforced plastics for use in aircraft manufacturing, the IFAM researchers have several other potential applications in mind. Ihde outlines an example: "We can increase the heat dissipation properties of electrical components by giving metal particles of copper or aluminum an



electrically insulating coating in the plasma and then mixing them into a polymer." This can be pressed onto an electronic component so heat is dissipated directly. "Overheating of elements is a major problem in the electronics industry," he adds. The researchers have also devised a way to reduce electromagnetic losses by using this plasma process to coat soft magnetic particles such as iron and then combining them with plastics. Built into electric motors, they cut eddy current losses, thus improving efficiency and lengthening service life. IFAM experts will be exhibiting surface-modified carbon nanotubes -- which demonstrate significantly enhanced miscibility with solvents -- at the K 2010 trade fair in Düsseldorf, from October 27 through November 3.

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**Story Source:**

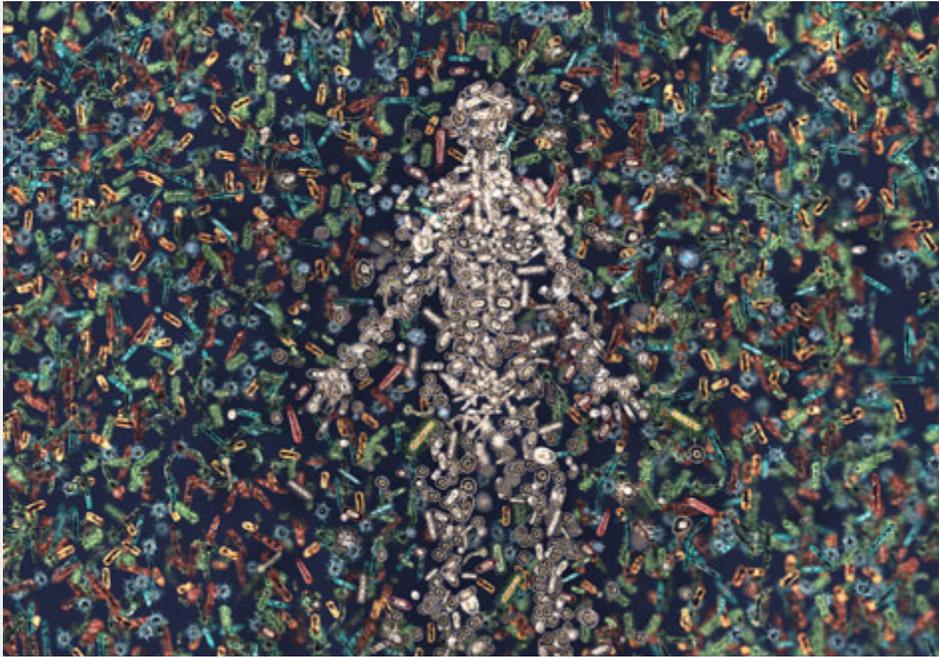
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<http://www.sciencedaily.com/releases/2010/10/101014113916.htm>

## Bacteria 'R' Us

*Emerging research shows that bacteria have powers to engineer the environment, to communicate and to affect human well-being. They may even think.*

By Valerie Brown



(Illustration by Bryan Christie)

A few scientists noticed in the late 1960s that the marine bacteria *Vibrio fischeri* appeared to coordinate among themselves the production of chemicals that produced bioluminescence, waiting until a certain number of them were in the neighborhood before firing up their light-making machinery. This behavior was eventually dubbed “quorum sensing.” It was one of the first in what has turned out to be a long list of ways in which bacteria talk to each other and to other organisms.

Some populations of *V. fischeri* put this skill to a remarkable use: They live in the light-sensing organs of the bobtail squid. This squid, a charming nocturnal denizen of shallow Hawaiian waters, relies on *V. fischeri* to calculate the light shining from above and emit exactly the same amount of light downward, masking the squid from being seen by predators swimming beneath them.

For their lighting services, *V. fischeri* get a protected environment rich in essential nutrients. Each dawn, the squid evict all their *V. fischeri* to prevent overpopulation. During the day, the bacteria recolonize the light-sensing organ and detect a fresh quorum, once again ready to camouflage the squid by night.

This tale of bobtail squid would be just another mildly jaw-dropping story in a natural world full of marvels if it weren't a portal into an unsuspected realm that has profound consequences for human beings. Regardless of

the scale at which we explore the biosphere — whether we delve into the global ocean or the internal seas of individual organisms — bacteria are now known to be larger players than humans ever imagined.

Do bacteria think? Is Facebook a medical record? Can we reform welfare reform? Check out those stories, our cover story on dealing with climate change through ocean carbon sequestration, and much more in the November-December 2010 issue of *Miller-McCune* magazine.

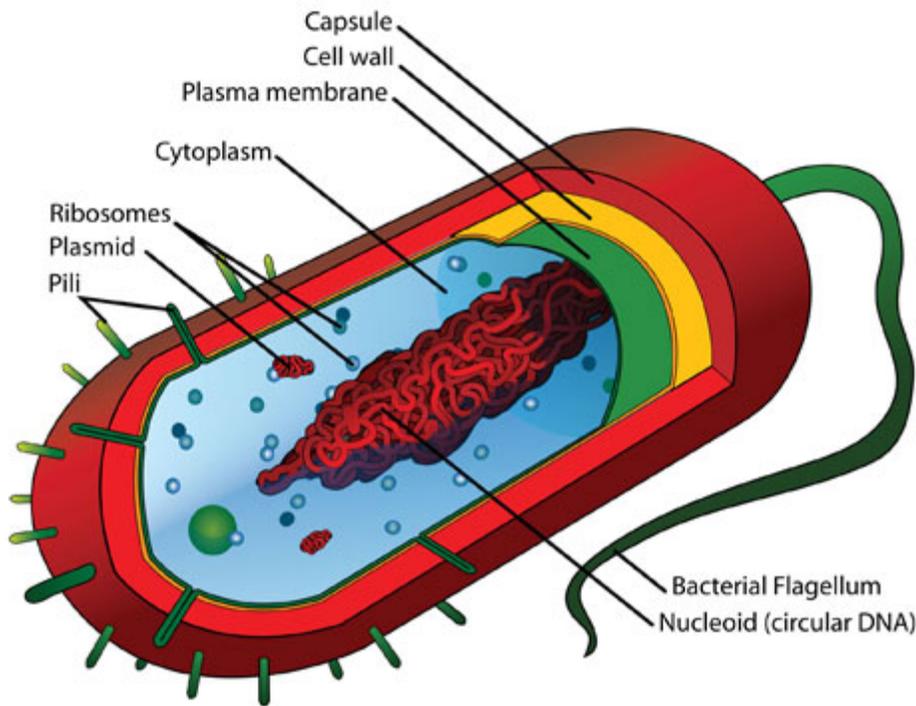
Strictly by the numbers, the vast majority — estimated by many scientists at 90 percent — of the cells in what you think of as your body are actually bacteria, not human cells. The number of bacterial species in the human gut is estimated to be about 40,000, according to Daniel Frank and Norman Pace, writing in the January 2008 *Current Opinion in Gastroenterology*. The total number of individual bacterial cells in the gut is projected to be on the order of 100 trillion, according to Xing Yang and colleagues at the Shanghai Center for Bioinformation Technology, reporting in the June 2009 issue of *PLoS One*, a peer-reviewed online science journal. Xing calculated a ballpark figure for the number of unique bacterial genes in a human gut at about 9 million.

In fact, most of the life on the planet is probably composed of bacteria. They have been found making a living in Cretaceous-era sediments below the bottom of the ocean and in ice-covered Antarctic lakes, inside volcanoes, miles high in the atmosphere, teeming in the oceans — and within every other life-form on Earth.

These facts by themselves may trigger existential shock: People are partly made of pond scum. But beyond that psychic trauma, a new and astonishing vista unfolds. In a series of recent findings, researchers describe bacteria that communicate in sophisticated ways, take concerted action, influence human physiology, alter human thinking and work together to bioengineer the environment. These findings may foreshadow new medical procedures that encourage bacterial participation in human health. They clearly set out a new understanding of the way in which life has developed on Earth to date, and of the power microbes have to regulate both the global environment and the internal environment of the human beings they inhabit and influence so profoundly.

There's such ferment afoot in microbiology today that even the classification of the primary domains of life and the relationships among those domains are subjects of disagreement. For the purposes of this article, we'll focus on the fundamental difference between two major types of life-forms: those that have a cell wall but few or no internal subdivisions, and those that possess cells containing a nucleus, mitochondria, chloroplasts and other smaller substructures, or organelles. The former life-forms — often termed prokaryotes — include bacteria and the most ancient of Earth's life-forms, the archaea. (Until the 1970s, archaea and bacteria were classed together, but the chemistry of archaean cell walls and other features are quite different from bacteria, enabling them to live in extreme environments such as Yellowstone's mud pots and hyperacidic mine tailings.) Everything but archaea and bacteria, from plants and animals to fungi and malaria parasites, is classified as a eukaryote.

Science has determined that life arose and became complex through a process generally known as evolution, but biologists are engaged in an energetic debate about the form of that evolution. In essence, the argument centers on whether the biosphere should be characterized as a tree of life or an interactive web. In the tree construct, every living thing springs from a common ancestor, organisms evolve slowly by means of random mutations, and genes are passed on from parent to offspring (that is to say, vertically). The farther away from the common ancestor, generally speaking, the more complex the life-form, with humans at the apex of complexity.



The prokaryotes are a group of organisms that lack a cell nucleus or other membrane-bound organelles. (wikimedia)

The tree-of-life notion remains a reasonable fit for the eukaryotes, but emerging knowledge about bacteria suggests that the micro-biosphere is much more like a web, with information of all kinds, including genes, traveling in all directions simultaneously. Microbes also appear to take a much more active role in their own evolution than the so-called “higher” animals. This flies in the face of the more radical versions of Darwinism, which posit that the environment, and nothing else, selects genes, and that there is no intelligence, divine or otherwise, behind evolution — especially not in the form of organisms themselves making intentional changes to their heritable scaffolding. To suggest that organisms as primitive as bacteria are capable of controlling their own evolution is obviously silly.

Isn't it?

In terms of the pace of evolutionary change, one advantage the single-celled have over complex organisms is reproductive speed. Unlike eukaryotes, bacteria usually reproduce by cloning, which simply copies the single parent's entire set of genes. If conditions are favorable, a population of bacteria can double every 20 minutes or so.

Achieving genetic diversity is a whole different thing. Most eukaryotes engage in sex, which combines reproduction with genetic mixing. This produces offspring carrying half of each parent's genes. But bacteria don't have sex, they transfer genes among themselves horizontally — and they do a lot of transferring. The primary method most bacteria use is called “conjugation,” a process in which genetic material is transferred between two bacteria that are in contact. It's as close as they come to sex (although, as far as we know,

lacking the romance; it's more like downloading handy little apps from a cool website). In principle, every bacterium can exchange genes with every other bacterium on the planet. A side effect of this reality: The notion of separate bacterial species is somewhat shaky, although the term is still in use for lack of a better alternative.

And bacteria don't just get together for "file sharing." Even before quorum sensing was discovered in *V. fischeri*, scientists had noted many examples of coordinated action, such as "swarming," in which a colony of bacteria moves as a unit across a surface, and the development of "fruiting bodies," in which bacteriaglom together to form inert spores as a means of surviving severe environmental conditions. Since the dominant paradigm assumed that bacteria were dumb, discrete individuals, these phenomena tended to be glossed over until *Vibrio*'s highly sophisticated census-taking focused new attention on coordinated bacterial behavior. Group behavior has now been demonstrated so widely that many microbiologists view bacteria as multicellular organisms, much of whose activity — from gene swapping to swarming to biofilm construction — is mediated by a wide variety of chemical communications.

Bacteria use chemicals to talk to each other and to nonbacterial cells as well. These exchanges work much as human language does, says Herbert Levine of the University of California, San Diego's Center for Theoretical Biological Physics. With colleagues from Tel Aviv University, Levine proposed in the August 2004 Trends in Microbiology that bacteria "maintain linguistic communication," enabling them to engage in intentional behavior both singly and in groups. In other words, they have "social intelligence."



The Titanic, draped with colonies of bacteria. (Courtesy of Lori Johnson, RMS Titanic Expedition 2003, NOAA-OE)

Bacteria can live solitary lives, of course, but they prefer to aggregate in biofilms, also known as “slime cities.” Biofilms usually form on a surface, whether it’s the inner lining of the intestines or inside water pipes or on your teeth. In these close-knit colonies, bacteria coordinate group production of a slimy translucent coating and fibers called “curli” and “pili” that attach the colony to something else. Biofilms can harbor multiple types of bacteria as well as fungi and protists (microscopic eukaryotes). A complex vascular system for transporting nutrients and chemical signals through a biofilm may also develop. As Tim Friend described in his book *The Third Domain*, explorers diving to the wreck of the *Titanic* found these features in “rusticles” — draped colonies of microbes — feeding on the iron in the *Titanic*’s hull and skeleton, more than 2 miles under the surface.

The abilities of bacteria are interesting to understand in their own right, and knowing how bacteria function in the biosphere may lead to new sources of energy or ways to degrade toxic chemicals, for example. But emerging evidence on the role of bacteria in human physiology brings the wonder and promise — and the hazards of misunderstanding them — up close and personal.

Because in a very real sense, bacteria are us.

In 2007, the National Institutes of Health began an ambitious program called the Human Microbiome Project, which aims to take a census of all the microorganisms that normally live in and on the human body. Most of these live in the digestive tract, but researchers have also discovered unique populations adapted to the inside of the elbow and the back of the knee. Even the left and right hands have their own distinct biota, and the microbiomes of men and women differ. The import of this distribution of microorganisms is unclear, but its existence reinforces the notion that humans should start thinking of themselves as ecosystems, rather than discrete individuals.

As of early 2010, the Human Microbiome Project had collected samples of microbial DNA from about 300 people and had sequenced or prepared to sequence the genomes of about 500 bacterial strains from these samples. Fifteen studies of microbial involvement in human disease have been funded. “These sorts of trials take time,” says Microbiome Project program director Susan Garges, so clinical treatments based on the research from the project could be years off unless, she says, “in the shorter term, specific microorganisms are associated with a disease state.” In that case, protocols for clinical diagnosis and treatment might be accelerated.

But the microbiome project is not just about disease-causing microbes such as *E. coli* and *Staphylococcus* strains. Many of the organisms it is identifying are responsible for regulating the digestive tract and keeping humans healthy in a variety of ways.

The human gut is filled with large numbers of a wide variety of bacteria; clearly those that cause disease must rank high on the priority list of those to be studied, but the picture emerging from new research is that pathogens and beneficial bacteria are not necessarily mutually exclusive organisms. A microbe’s effects on the human body can depend on conditions. And if you approach the human body as an ecosystem, some researchers are finding, it may be possible to tune that system and prevent many diseases — from acute infections to chronic debilitating conditions — and even to foster mental health, through bacteria.

Recent research has shown that gut microbes control or influence nutrient supply to the human host, the development of mature intestinal cells and blood vessels, the stimulation and maturation of the immune system, and blood levels of lipids such as cholesterol. They are, therefore, intimately involved in the bodily functions that tend to be out of kilter in modern society: metabolism, cardiovascular processes and defense against disease. Many researchers are coming to view such diseases as manifestations of imbalance in the

ecology of the microbes inhabiting the human body. If further evidence bears this out, medicine is about to undergo a profound paradigm shift, and medical treatment could regularly involve kindness to microbes.

Still, in practice, the medical notion of friendly microbes has yet to extend much past the idea that eating yogurt is good for you. For most doctors and medical microbiologists, microbes are enemies in a permanent war. Medicine certainly has good reason to view microbes as dangerous, since the germ theory of disease and the subsequent development of antibiotics are two of medical science's greatest accomplishments.

But there's a problem: The paradigm isn't working very well anymore. Not only are bacteria becoming antibiotic-resistant, but antibiotics are creating other problems. Approximately 25 percent of people treated with antibiotics for an infection develop diarrhea. Moreover, people who contract infections just by being hospitalized are at risk of developing chronic infections in the form of biofilms. These not only gum up the works of devices such as IV tubes, stents and catheters, but also protect their constituent microbes from antibiotics.

In addition to antibiotic-resistant *E. coli* and *Salmonella* that often spread through our food supply, common pathogens that make doctors' blood run cold include *Pseudomonas aeruginosa* and *Clostridium difficile*. *P. aeruginosa* is responsible for about 40 percent of all fatalities from hospital-acquired infections. *C. difficile* is the culprit in at least a quarter of diarrhea cases caused by antibiotics. A 2007 study by the Los Angeles County Department of Public Health found that mortality rates from *C. difficile* infections in the United States quadrupled between 1999 and 2004. *C. difficile* will invade an antibiotic-cleansed colon and "poke holes in it," says Vincent Young, a gastrointestinal infection specialist at the University of Michigan. Some people in this situation rush to the bathroom 20 times a day. "It's not just an inconvenience," Young says.

Many researchers are focusing on inflammatory bowel disorders to understand how the balance between the intestinal microbes and their human hosts becomes deranged. Incidence of these diseases has sharply increased since about the mid-20th century, just about the time the industrialized world started eating highly processed foods and antibiotics came into widespread use. For example, in bowel disorders such as Crohn's disease and ulcerative colitis, excessive inflammation leads to severe pain, diarrhea and vulnerability to opportunistic germs. Standard treatments include powerful steroids like prednisone, surgical removal of the colon and heavy treatment with antibiotics.

But a more ecological approach is beginning to offer hope. *P. aeruginosa* and *C. difficile* are common residents of human bodies and under normal circumstances are benign. So what turns them into enemies? Most of the time, says John Alverdy, an intestinal and critical-care surgeon at the University of Chicago, bacteria "have to have a reason to hurt you." Surgery is just such a reason. A surgical patient's normal metabolism is altered; usually nutrients are provided intravenously instead of through the digestive system, so in a patient being fed by an IV drip, the gut bacteria perceive their sustenance disappearing. A decline in available nutrients alarms them. And surgery triggers the release of stress compounds that bacteria also sense, Alverdy says. Chemotherapy and radiation have similar effects. When threatened, bacteria become defensive, often producing toxins that make the host even sicker. They also tend to speed up their acquisition of and purging of genes when under external selection pressure, of which antibiotics are an obvious and powerful example.

Alverdy is finding success in treating patients with a strategy he calls "ecologic neutrality." In research reported in the August 2008 *Surgery*, he was able to prevent *P. aeruginosa* from turning virulent in surgically stressed mice by dosing them with polyethylene glycol, which supplies the bacteria with phosphate, one of their primary needs. "Once they sense there's plenty of phosphate," he says, "they figure everybody must be happy here." The treated mice in his experiments, unlike the controls, did not contract fatal infections.

Some researchers are even exploring the idea of stool transplants — that is, introducing a healthy person’s gut bacteria into a sick person’s intestines via the donor’s feces. Although there are not many peer-reviewed studies of this rather disturbing concept, a review in the July 2004 *Journal of Clinical Gastroenterology* by Australian researcher Thomas Borody found that in a large majority of the cases reported in the medical literature, fecal transplants resulted in almost immediate and long-lasting relief for people suffering from inflammatory bowel conditions and for those with chronic antibiotic-induced diarrhea. (There’s definitely a market for fecal transplants. When one scientist mentioned the success of the procedure in an interview with *The Wall Street Journal*, he was inundated with calls from desperate patients begging for the treatment, even though he does not practice the therapy.)

If new therapies based on human microbial ecology just lessened antibiotic resistance and relieved the suffering of people with intestinal disorders, they would constitute miraculous advances. But the intensifying focus on the role of bacteria in human health is turning up other possible avenues for improving health.

Gut bacteria play a role in obesity, which affects about a third of American adults. The gut bacteria populations of the obese are less diverse than those of normal-weight people. Researchers have found that children whose fecal bacteria are composed more of *Staphylococcus aureus* than *Bifidobacteria* at birth are more likely to become overweight later in life. Interestingly, one study found that the microbiota of obese adults were very different from the bacteria populations of both normal-weight people and obese people who had had gastric bypass surgery. Researchers from Arizona State University and the Mayo Clinic noted that in obese people, there appeared to be a cooperative relationship between hydrogen-producing bacteria and the one archaean resident of the human gut, a hydrogen-consuming, methane-producing organism. The archaean partner makes fermentation of indigestible polysaccharides (which are complex carbohydrates) more efficient, and the extra fermentation products are converted to fat by the intestines. It appears that obese people’s gut microbes are just too good at their jobs.

Research in animals supports the idea that gut bacteria play a role in weight regulation. According to recent research by Emory University pathologist Andrew Gewirtz and his colleagues, mice bred without a gene that allows them to detect the presence of gut bacteria unexpectedly became overweight and suffered from high blood pressure, high triglycerides and high cholesterol. When given access to a high-fat diet, they developed full-blown diabetes. Fecal transplants from these mice to normal mice transferred the health problems.

Despite these fascinating hints, scientists don’t yet know whether changes in microbial equilibrium are the chicken or the egg — that is, whether they cause or are caused by obesity — making it unclear whether restoring a proper gut ecosystem can become a magic bullet to fire against obesity.

Researchers have found several reasons to believe that bacteria affect the mental health of humans. For one thing, bacteria produce some of the same types of neurotransmitters that regulate the function of the human brain. The human intestine contains a network of neurons, and the gut network routinely communicates with the brain. Gut bacteria affect that communication. “The bugs are talking to each other, and they’re talking to their host, and their host talks back,” Young says. The phrase “gut feeling” is probably, literally true.

For example, it’s been known for a while that sick people get depressed and anxious. This seems so obvious as to be a no-brainer, but research suggests that some of the fear and fatigue associated with infections stems from immune responses affecting the brain.

Mark Lyte of the Texas Tech University School of Pharmacy noticed that lab mice dosed with *Campylobacter jejuni*, bacteria that are commonly a cause of food poisoning, were more anxious than control mice. After several experiments, Lyte’s team concluded that the vagus nerve, which extends into the colon, was probably

transmitting the news of a gut infection to the brain areas involved in emotions. Reporting their results in the August 2007 *Brain, Behavior and Immunity*, the team also conjectured that the anxiety often exhibited by victims of bowel disorders may operate on the same network, which is not under conscious control.

Even more intriguingly, there have long been hints that some bacteria, including *Bifidobacteria* commonly found in yogurt, can improve mood. A common soil microbe, *Mycobacterium vaccae*, has recently been found to cheer up lab mice in experiments by Christopher Lowry, an integrative physiology professor at the University of Colorado at Boulder. Lowry and colleagues showed that infection with *M. vaccae* “alters stress-related emotional behavior” in mice by activating neurons producing serotonin, the neurotransmitter affected by Prozac.

Since the days of Pasteur and Koch, to be classified as disease-causing, a bacterium has had to be grown in culture, isolated from all other organisms. As it turns out, however, very few bacteria can be grown in the relatively austere conditions of laboratories. In fact, only about 0.1 percent of all bacteria are currently culturable. Many bacteria don’t do well in monoculture, preferring to live in mixed communities of microorganisms. Those living in extreme temperatures and pressures require very specialized equipment to grow in a typical lab.

Developments in gene sequencing have cast light into the murk of the bacterial world. Instead of the old-school method of isolating and growing each type of bacteria separately, microbiologists are just dipping into biological stews to see what genes they contain. Through metagenomics — the high-throughput technology used to sequence the human genome — they analyze multiple samples of genetic material simultaneously, at high speed and low cost.

Beyond the universe of bacterial genes recently discovered in the human gut, surveys of marine microbes are producing similarly staggering numbers of genes and species. This spring, J. Craig Venter and co-authors reported that samples of seawater taken near Bermuda yielded 150 new types of bacteria and more than a million previously unknown genes — this in an area of open ocean thought to be low in nutrients and sparsely populated by microorganisms.

R. John Parkes, a researcher at the University of Cardiff, Wales, studies microbes found in core samples collected by the Ocean Drilling Program from rocks deep below the ocean floor. “For a long time, these deep sediments were thought to be devoid of any life at all,” he says. There’s life down there, all right, but talk about slow metabolism: When Parke analyzed 4.7 million-year-old organic sediment in the Mediterranean, he estimated the average time it took for resident microbes to reproduce by cell division at *120,000 years*. And he reported finding living bacteria just over a mile *below* the seafloor, in sediments 111 million years old and at temperatures of 140 to 212 degrees Fahrenheit.

Most of the ocean floor — about 70 percent of the Earth’s surface — is covered with such sediments, formed by the constant rain of sand and other particles through the water column. Below the sediments are layers of igneous rocks that ooze from long cracks on the seafloor. It’s counterintuitive, to put it mildly, to imagine anything would live in this formerly molten rock where it meets the staggering pressure and cold of the lightless deep. But guess what? There may be more life in these rocks at the gates of hell than there is in the relatively paradisiacal environments above.

Oregon State University microbiology professor Stephen Giovannoni and his graduate student Olivia Mason used metagenomics to survey microbes in basalt along the East Pacific Rise southwest of Mexico, in the Juan de Fuca strait off the coast of Washington state and elsewhere. They found that the communities in the rocks

were clearly distinct from the sorts of bacteria common in seawater and, as Mason wrote in her 2008 doctoral dissertation, their total biomass may outstrip that of life in the oceans.

These and other new findings suggest that microbes deep in submarine rock may play a heretofore unrecognized role in the regulation of not just the oceans, but the global environment.

Wherever they live, bacteria can take most of the credit for bringing planetary geology into the service of life. They started working on these processes promptly upon their first emergence, perhaps as early as a mere billion years into Earth's 4.5-billion-year history. Both the energy-releasing chemical reactions and the assembly of complex organic molecules necessary for life are, Rutgers University professor Paul G. Falkowski and his co-authors wrote in *Science*, "an emergent property of microbial life on a planetary scale." In fact, they wrote, the genes that enable these processes today "may have been distributed across a common global gene pool, before cellular differentiation and vertical genetic transmission evolved as we know it today."

In other words, bacteria are supreme code monkeys that probably perfected the packages of genes and the regulation necessary to produce just about every form of life, trading genetic information among themselves long before there was anything resembling a eukaryotic cell, let alone the masters of the universe that humans believe humans to be.

Bacteria, says Giovannoni admiringly, are marvels of engineering. "When it comes to biochemistry, they are much better than eukaryotes," he says. "They don't waste things. They're very efficient, very clever. They keep it simple but very elegant and sophisticated."

But just how smart are they, really?

Giovannoni stops short of claiming that bacteria are actually thinking. But the litany of bacterial talents does nibble at conventional assumptions about thinking: Bacteria can distinguish "self" from "other," and between their relatives and strangers; they can sense how big a space they're in; they can move as a unit; they can produce a wide variety of signaling compounds, including at least one human neurotransmitter; they can also engage in numerous mutually beneficial relationships with their host's cells. Even more impressive, some bacteria, such as *Myxococcus xanthus*, practice predation in packs, swarming as a group over prey microbes such as *E. coli* and dissolving their cell walls.

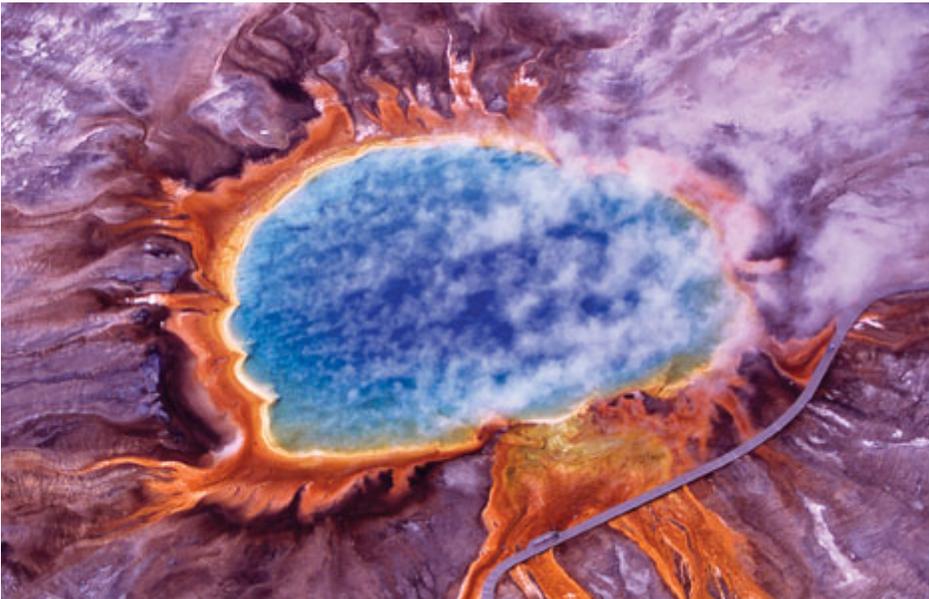
At least one scientist was willing to allow for the possibility of bacterial thinking quite early in the development of microbiology: Alfred Binet, who invented the first reliable intelligence test and who published a book in 1888 called *The Psychic Life of Microorganisms*. And today the idea of thinking microbes is gaining ground. Marc van Duijn and colleagues at the University of Groningen in The Netherlands point out in the June 2006 issue of *Adaptive Behavior* that the presence of "the basic processes of cognition, such as perception, memory and action" in bacteria can now be "plausibly defended." And bacteria that have antibiotic-resistance genes advertise the fact, attracting other bacteria shopping for those genes; the latter then emit pheromones to signal their willingness to close the deal. These phenomena, Herbert Levine's group argues, reveal a capacity for language long considered unique to humans.

One way to get around the conclusion that bacteria think the way humans think is to say that all the complexity in the world emerges from the simple actions of many "dumb" actors — biological molecules and individual cells, whether they are elegantly differentiated parts of a multicellular organism or bacteria and archaea. In this view, neither some overriding sentience nor individual organisms have any influence over the process.

So maybe bacteria are just computers, which so far, despite humans' unending fantasies of conscious machines, aren't yet really thinking. But University of Chicago microbial geneticist James Shapiro believes they come extremely close. He sees bacteria as consummate practitioners of information management, plus a bit more. They "have ways of acquiring information both from the outside and the inside," he says, "and they can do appropriate things on the basis of that information. So they must have some way to compute the proper outcome." It is these "sophisticated information processing capacities," Shapiro wrote in the paper "Bacteria Are Small but not Stupid," that represent "another step away from the anthropocentric view of the universe. ... Our status as the only sentient beings on the planet is dissolving as we learn more about how smart even the smallest living cells can be."

On the other hand, Tufts University philosopher of science Daniel Dennett, a prominent member of the emergent complexity camp, will only grant bacteria "semi-smart" status. Unlike bacteria, human neurons combine in ways that enable intention, Dennett wrote in his 1996 book *Kinds of Minds*. This intentionality is what he thinks sets us apart from the single-celled among us. We possess "different software — the information that organizes the teamwork of all those semi-smart robots," he says.

But this raises the question: Is some nonhuman software organizing the teamwork of all those nonhuman semi-smart robots, aka bacteria? For this would be the truly radical argument: that bacteria — demonstrably integrated deeply and broadly into the entire planet, shaping its geochemistry, creating substrates and chemical processes that support the development of complex organic molecules, regulating the cycling of energy and nutrients both in "higher" organisms and their environments — constitute a kind of distributed awareness encompassing the whole planet. That not only are bacteria in a given local environment busy texting each other like mad, but the entire planet may consist of a giant Microbial World Wide Web.



An aerial view of Grand Prismatic Spring in Yellowstone National Park. This hot spring is about 250 by 300 feet. The photo shows steam rising from blue water, surrounded by huge mats of brilliant orange algae and bacteria. (wikimedia)



That bacteria-centric argument is, of course, a hazy, metaphysical Gaian fantasy worthy of Avatar. In a more down-to-earth assessment, it is clear that bacteria are not what the general run of humans thought they were, and neither are humans. Bacteria are the *sine qua non* for life, and the architects of the complexity humans claim for a throne. The grand story of human exceptionalism — the idea that humans are separate from and superior to everything else in the biosphere — has taken a terminal blow from the new knowledge about bacteria. Whether humanity decides to sanctify them in some way or merely admire them and learn what they're really doing, there's no going back. And if there's any hope of rebalancing the chemistry of a biosphere deranged in two short centuries by humans, it very likely lies in peaceful coexistence with the seemingly brilliant, deceptively simple life-forms comprising the domain Bacteria.

[http://www.miller-mccune.com/science-environment/bacteria-r-us-23628/?utm\\_source=Newsletter131&utm\\_medium=email&utm\\_content=1019&utm\\_campaign=newsletters#](http://www.miller-mccune.com/science-environment/bacteria-r-us-23628/?utm_source=Newsletter131&utm_medium=email&utm_content=1019&utm_campaign=newsletters#)

## Mountaintop-Removal Coal Mining Battle Hits ‘Deep Down’

PBS documentary “Deep Down” looks at a cordial, intense dispute over mountaintop-removal coal mining in Appalachia.

By [Tom Jacobs](#)



*This is what mountaintop-removal mining looks like in progress. (Courtesy of "Deep Down")*

In the opening minutes of their documentary *Deep Down*, filmmakers [Sally Rubin](#) and [Jen Gilomen](#) take us down a winding back road in eastern Kentucky. It’s fall, and the leaves are changing, adding to the idyllic beauty of the mountainous surroundings. But around one bend is a rectangular sign bearing an ominous message: “Blasting Schedule.” It might as well add, “Enjoy the view while it lasts.”

For this is coal country, and in recent years the industry has come to realize the quickest, cheapest way to extract the precious commodity is to simply blast away. Why bother with digging a dirty, dangerous mine when you can use explosives to tear off the top of a mountain, exposing all that lovely black fossil fuel underneath?

More than 500 [Appalachian mountains](#) have been decimated in this way. But Beverly May, a fourth-generation resident of the region, is determined such desecration will not happen in her hollow. A nurse practitioner and community activist, she is one of two protagonists in this compelling and fair-minded film, which makes its national debut [Nov. 23 on PBS](#) and brings to life a local battle with wide-ranging implications.

The other is Terry Ratliff, a woodworker and chair maker. He lives in a log house he built in the woods — a structure, he notes ruefully, that represents his attempt to escape the rat race. But the dollar-driven world catches up with him in the form of a coal company representative who comes knocking one day with an admittedly tempting offer.

The company wants to lease a small plot of land Ratliff owns just up the hill from his home. The structure is 1,100 feet above sea level; the company plans to blast the mountain down to 1,200 feet. But the representative assures him there is no danger to his house, and Ratliff, like pretty much everyone in this poverty-stricken area, could use the money. He is, understandably, torn.

May, on the other hand, is certain of her stance. “You don’t regulate an abomination,” she declares. “You stop it.” She engages in a two-front battle against the coal company, organizing reluctant citizens to join her in

petitioning a state regulatory body and quietly attempting to persuade Ratliff not to sell. “There’s plenty of things you can’t put a dollar value on,” she argues. “If you have plenty of dollars,” he replies.

Their discussions are low-key, cordial and respectful. Ratliff (who would be played by Sam Shepard in a feature film) doesn’t see an absolute need to keep the landscape pristine. “This land is resilient,” he says, noting that other mined areas have been returned to nature with some success. On the other hand, he shares May’s concerns about polluting the watershed and worries about how the altered topography would impact the water flows during the next heavy rainfall. “This is not an easy thing,” he says quietly, weighing every word.

If it isn’t obvious by now, these are thoughtful, eloquent individuals who couldn’t be farther from the stereotype of ignorant hillbillies. No one belittles anyone else’s views, and everyone does his or her best to understand others’ concerns. “There is an attitude in Appalachia of live and let live,” noted co-director Rubin, who lives in Los Angeles but has family ties to Tennessee. “You may disagree with someone, but they’re still your neighbor, and it’s not your job to tell anybody else how to live their life.”

Still more clichés fall as May’s campaign gathers steam, culminating in a hearing before a state board to determine whether their mountain is suitable for this form of mining. There are passionate pleas on both sides of the argument, and God is often invoked. But even in the Bible Belt, faith leads different people to different conclusions: Some argue the almighty put that coal there for humans to use, while others say people should protect the natural world God entrusted them with.

One woman makes a pertinent point in response to those who argue blast mining is an economic necessity. Why, she asks, is the local economy still so fragile and dependent upon coal after more than a century of mining? There are no nouveau riche Beverly Hillbillies here; if anyone is getting rich off these resources, it’s not the locals.

The filmmakers tell their story with sensitivity and a strong visual sense. In one particularly arresting image, May and Ratliff, who are longtime neighbors and friends, perform a traditional mountain folk dance in which they come close but never touch. Their unassuming artistry conveys a combination of attraction and wariness, making it a vivid artifact of the Appalachian culture the mining is threatening to destroy.

Rubin and Gilomen lay out two primary goals for the documentary on their “Deep Down” website. They hope viewers will come away with a more accurate picture of mountain people and give some thought to the actual cost of “cheap” energy. The highly observant Ratliff notes at one point that the greenhouse gases emitted by burning coal (the dirtiest of fuels in that respect) is a much bigger problem than the destruction of certain mountains, or even certain mountain communities.

But climate change remains an amorphous concept for most people. In contrast, what’s happening to these mountains and their inhabitants is immediate, tangible and heartbreaking. “Often people will come back to us a week after they’ve seen the film and report they’ve been turning off their lights,” Rubin reports. “That’s a little thing, but it’s nice to know people have been moved to action.”

<http://www.miller-mccune.com/science-environment/mountaintop-removal-coal-mining-battle-hits-deep-down-23710/>

## Global Warming: the Archaeological Frontier

*Melting glaciers yield evidence on new theories of Asian migration to the Americas. Underwater robots search the sea bottom, looking for more.*

By Michael Haederle



*Artifacts recovered from an alpine ice patch in the Yukon. (Courtesy of government of Yukon)*

In the small laboratory next to his office at the Maxwell Museum of Anthropology in Albuquerque, N.M., Jim Dixon unlocks a large steel cabinet, slides open a drawer and gingerly lifts out a thin piece of gray, brittle-looking wood. “This fragment is actually a spear shaft,” he says and then shows me a dart shaped to fit into the socket of an ancient spear-thrower called an atlatl. “This is the stone point with sinew lashing. This is very fragile. This is about 2,800 years old.”

Opening one drawer after another, Dixon displays dozens of other artifacts — arrows, some decorated with red ochre, the fletching still attached, and arrowheads carved from stone and caribou antler. There is even a rare arrow point hammered from a nugget of copper.

Dixon has discovered these ancient hunting implements over the past decade in the unlikeliest of places — patches of melting ice high in the mountains of southeastern Alaska. Set in sheltered basins and seldom more than a few acres in size, these durable accumulations of snow and ice have built up over thousands of years, remaining intact throughout the short sub-Arctic summers. “They’ve been uniquely preserved in these frozen environments,” Dixon says of his collection of fragile organic artifacts. “They give us a glimpse of the archaeological record that we don’t ordinarily get.”

During a few weeks each August — the brief window for high-latitude fieldwork — Dixon and his team fly around Wrangell-St. Elias National Park and Preserve in a helicopter, setting down at remote ice patches to conduct ground searches along their melting edges. The artifacts are often lying in the open, waiting to be picked up, like shells on a beach at low tide.

More of these objects are coming to light as warming temperatures shrink the ice patches where they have been preserved. This invests the ongoing search with promise and urgency, he says.

“This is a phenomenon that’s going on globally,” Dixon says. “Ancient ice is melting for the first time. We know that because the types of artifacts that are coming out are organic — they’re very fragile, and they decompose very rapidly, within just a matter of years when they’ve been exposed from the ice. So we know they haven’t been laying on the surface there for thousands of years.”



Large-diameter dart shafts recovered from Yukon. Each black or white rectangle in the pictured scaling bars is 1 centimeter long. (Government of Yukon)

As a leading expert on the early settlement of western North America, Dixon has made a career out of challenging academic orthodoxy and looking for fresh archaeological evidence in unexpected places. Lately, he has been exploring the shallow waters off the Alaska Panhandle with a remotely operated underwater vehicle, trying to prove a theory that people first migrated to North America during the last ice age by following the north Pacific coast, rather than hiking the inland route that most scientists favor.

“He’s not hung up on safe science and reproducing the same results that someone else has done,” says Craig Lee, a colleague who had Dixon as his doctoral adviser. “He definitely would be in the vanguard of discovery when it comes to finding stuff. This ice patch research — that’s going out on a limb.”

“I always had a curiosity as a child about the past,” Dixon says, sheepishly admitting to picking up arrowheads in the cornfields near his New Jersey home — something professionals frown upon as akin to pot hunting. Later, while earning a master’s degree in anthropology at the University of Alaska Fairbanks, Dixon

joined in an archaeological survey along the planned route of the Trans-Alaska Pipeline and discovered a number of early Native-American sites, including one that was more than 10,000 years old.

Dixon later taught and served as curator of archaeology at the UAF museum. He became curator of archaeology at the Denver Museum of Natural History in 1994, then was hired by the University of Colorado to head its graduate program in museum studies and serve as a research fellow at the Institute of Arctic and Alpine Research. The University of New Mexico lured him away to head the Maxwell Museum in December 2007.

Dixon has long been interested in how the first humans arrived in the New World. The dominant theory is that hunters from Siberia crossed the Bering land bridge that emerged during the last ice age some 13,000 years ago, when sea levels were lower. They are thought to have moved into North America through an ice-free corridor between the Cordilleran and Laurentide ice sheets that covered much of the continent at the time, evolving into the so-called Clovis culture that was widespread throughout North America.

But there is a growing body of contradictory evidence.

“I think several of us had been struggling for years with this idea that there were a number of archaeological sites throughout the Americas that appeared to predate the Clovis culture. The most parsimonious explanation was some kind of a coastal route,” says Dixon, who spelled all this out in his 1999 book *Bones, Boats and Bison: Archaeology and the First Colonization of Western North America*. “Along the north Pacific Rim seemed to be the most plausible because of the great genetic similarity between Native-American populations and the people of northeast Asia.”

During the last ice age, warm Pacific waters kept the northwest coast free of glacial ice, he says, and dry land extended well out onto the continental shelf. Paleontologists have found the remains of large mammals like the brown bear and caribou, as well as seals, fish and waterfowl — all of which could have sustained ancient hunters.

“If you know how to hunt and fish those animals, you’re basically adapted to this entire environment,” Dixon says, “and whether you’re in Oregon or Hokkaido, it basically doesn’t matter, in terms of making a living.” All he needs now, he adds with a wry laugh, is the archaeological evidence to prove his theory.

Enter the underwater robot. Dixon has had graduate student Kelly Monteleone putting data for the continental shelf around southeast Alaska’s Alexander Archipelago into a geographic information system database. The mapping system helps pinpoint search locations for Dixon’s team members, who guide the remotely operated vehicle from the deck of their research vessel — a converted fishing trawler. The robot scans the ocean bottom for signs of ancient human habitation, such as shell middens, charcoal, stone chips and pit house foundations.

“It’s just a vast frontier,” Dixon says. “To try to pinpoint specific spots is the trick, and that’s what we’re trying to do now.”

Epic archaeological finds often involve a bit of luck, as Greg Hare can attest. In 1997, a Canadian wildlife biologist hunting in the mountains of the southern Yukon Territory discovered a huge field of melting caribou dung in a mountainside ice patch. On a return visit with another biologist, he found a small stick with what looked like a string attached. They brought the object to Hare, a government archaeologist based in Whitehorse, Yukon. “We looked at it and thought, ‘Wow, it looks like part of an arrow,’” Hare remembers.

He had the stick radiocarbon dated: It was 4,300 years old. Dung samples collected from a core drilled through the ice patch were more than 2,000 years old. Hare, whose job usually consisted of conducting archaeological surveys in advance of construction projects, knew he was on to something.

The next year, he and a team found artifacts at several sites, including an arrow shaft that was 6,800 years old. Since then, Hare has explored scores of dung-tinted ice patches, two dozen of which have archeological deposits.

Why were the artifacts so closely associated with evidence of caribou? Hare thinks it has to do with the creatures' migratory habits. Superbly adapted to arctic winters, they need to cool off and escape bugs in the summer heat, so they congregate on ice patches.

"That's a pattern that obviously gave a real advantage to hunters, because they knew where they had a good likelihood of running across groups of caribou," Hare observes.

Building on Hare's findings, Dixon decided to search in nearby Wrangell-St. Elias National Park, home to 18,000-foot Mt. St. Elias, the second-highest peak in the U.S., and hundreds of glaciers and ice patches. But his application to the [National Science Foundation](#) for research funding was met with skepticism. "Some of the reviews said things like, 'This is the most absurd thing we've ever heard of, because we know people didn't live on ice,'" Dixon recalls. "They really didn't get the complexity of it."

Along with Hare, Dixon is a "foundational figure" in gaining scientific acceptance for the validity of ice patch research, says Craig Lee, who has collaborated with Dixon in some of his fieldwork and conducted his own research in the Rocky Mountains and Alaska's [Denali National Park and Preserve](#). "It was Jim who said, 'Hey, there's a chance that this is not a localized phenomenon. It's not restricted to this little area, and there may be material that may be showing up in other spots.'"

In Wrangell-St. Elias, Dixon found artifacts in five of some 200 ice patches he surveyed. The search process is decidedly unglamorous. It starts with the pungent odor of thousand-year-old decomposing caribou dung. ("One of the tricks for searching for these is, 'Look for the brown ice,'" he confides). Far above timberline, Dixon and his team (some of whom are Native Americans) scout for pieces of wood, knowing only humans could have brought them. Often, the objects are half-buried in melting slush.

Dixon's artifact collection includes two rare darts from atlatls — the lever-like spear-throwers that enabled Native-American hunters to bring down large game. Some of the arrows feature "ownership marks" carved by their makers. They're exactly crafted from white spruce and fletched with feathers from birds of prey.

Each arrow represents a major investment of resources, with some components that must have been obtained through trade, Dixon says. They also tell something about what mattered to their makers. "This is an organic artifact that really objectifies people's thoughts," he says. "You get these glimpses into people's minds that you could never get from just a stone arrowhead."

The oldest ice patch artifacts Dixon has found are about 3,000 years old, while Greg Hare has found a few objects that are about 9,000 years old. But it turns out Dixon's former student Craig Lee, now a research scientist at the Institute of Arctic and Alpine Research, has recovered the oldest ice patch artifact in the world.

Three years ago, Lee found the 10,300-year-old foreshaft of an atlatl dart in the mountains near [Yellowstone National Park](#) — far south of Alaska and the Yukon. Although Lee's find has not been widely publicized,



Dixon says it confirms his conviction that ice patches and glaciers worldwide ought to be systematically surveyed before they disappear.

The past 20 years have also seen the discovery of eerily well-preserved frozen bodies in places as disparate as the Tyrolean Alps, the Andes and the mountains of northern British Columbia, Dixon notes. Recently, researchers have found Bronze Age artifacts high in the Swiss Alps and evidence of Viking reindeer-hunting parties in Norway.

Although Greg Hare agrees that more ice patch research is needed, he isn't sure whether the ice patches are shrinking as rapidly as he once feared.

His team has been taking careful measurements of ice fields each year, and so far the evidence is mixed. It could be that global climate change will bring greater snowfall to some mountain areas, even if temperatures grow warmer overall, he says.

"We've seen a reduction of the size of a number of the ice patches, but many of them have shown a pretty considerable reluctance to melt," he says. "The fact that they've been preserved for 9,000 years indicates that they're in a pretty protected environment."

Hare, meanwhile, believes the spate of ice patch discoveries point the way toward a new way of doing archaeology. "Rather than looking at the traditional low-lying areas, archaeologists are casting their eyes higher in the landscape and looking at mountain regions where there hadn't been a lot of activity before," he says. "People are seeing the ice melting and finding the presence of human use of the alpine that has been preserved for thousands of years."

<http://www.miller-mccune.com/science-environment/global-warming-the-archaeological-frontier-23704/>



## Solar Farming Spreads to Appalachia

*Ohio has reached a Turning Point with a solar-energy project that uses land that once was home to a strip mine.*

By Jessica Hilo



*Ohio is putting itself on the solar energy map by making something out of scorched earth. Land once strip mined by the Central Ohio Coal Company is set to house a 49.9-megawatt solar array. (Johan Bolhuis / stockxchange.com)*

Nearly 40 years ago, it was a strip mine used by the Central Ohio Coal Company. Now, 500 acres of land adjacent to The Wilds conservation park is set to house a \$250 million, 49.9-megawatt solar array.

“We recognized the future when we established our state’s aggressive renewable portfolio standard, invested in the energy industry and eliminated taxes for new energy facilities to create jobs and grow Ohio’s advanced energy industry,” said Ohio Gov. Ted Strickland, nodding to an executive order he signed in September.

“Today,” he announced on Oct. 5, “the future has recognized Ohio.”

Placing land-hungry solar generation facilities on swaths of land already roughed up by mining is increasingly common in the Western United States, especially the sun-blessed Southwest, as our David Rosenfeld reported recently. “Existing transmission lines, available water and roads capable of supporting wide, heavy loads provide ready-made infrastructure,” he wrote. “And reclaiming land that’s already been disturbed will reduce permitting costs.”

This Turning Point Solar project, however, is in Appalachia, known more for its coal mining detritus and less for its renewable energy portfolio. In Turning Point’s case, there was disturbed land aplenty: It’s going in on a



mining site created by Big Muskie, one of the biggest mining machines ever created. Twice as much earth reportedly was removed for this mine than occurred during the building of the Panama Canal.

Turning Point also hosts another superlative: Backers say it would be the largest photovoltaic solar farm in the United States. In addition, prairie planting tests are currently being conducted in hopes that the fallow land under the solar panels into an organic carbon sink.

It also includes a manufacturing component — expected to provide more than 300 permanent manufacturing jobs — not included in most Western plans.

Pending approval by the state and local governments, two solar power manufacturers from Spain, Prius Energy and Isofoton, have agreed to open new manufacturing facilities to help construct Turning Point's 239,400-panel solar array.

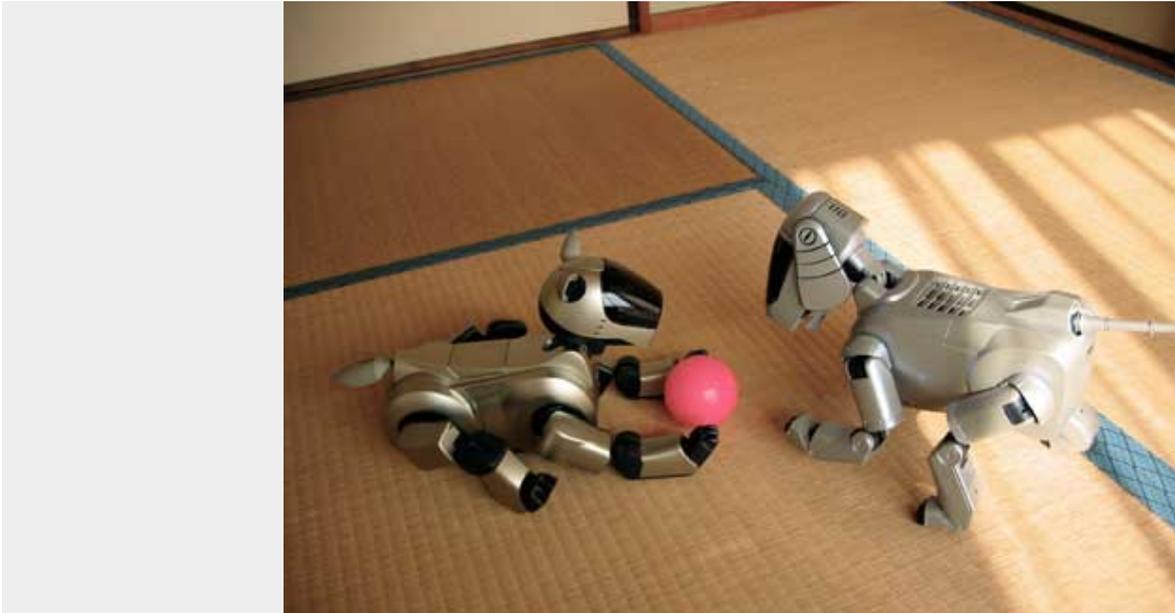
Turning Point Solar's project developers, New Harvest Ventures and Agile Energy entered into a 20-year purchase agreement for the facility's power with American Electric Power.

<http://www.miller-mccune.com/environment/solar-farming-spreads-to-appalachia-24030/>

## Different Cultures, Different Robots

*Industry might seem like a universal language, but how different cultures are husbanding their robots shows there are several dialects.*

By Sally Augustin



*AIBO, was one of several types of robotic pets designed by Sony. Japanese and Western robots reflect differences in the cultures in terms of expressiveness. Western robots tend to be more like independent teammates, where as the Japanese examples are more interdependent soul mates.(Wikipedia.org)*

Cultures have their own songs, holidays, special foods ... and robots.

Selma Sabanovic, an associate professor of informatics at Indiana University, described why last week during a talk on “Emotion in Robot Cultures” at the 7th International Conference on Design and Emotion in Chicago.

People building social robots in the West and in Japan are interested in ending up with two very different types of machines, she explained. Western robots are engineered to more explicitly express emotion, while those from Japan are generally as expressive as the masks worn by actors in traditional Japanese Noh plays.

(Social robots interact with people in real-world, everyday situations — one is used as a receptionist at Carnegie Mellon University’s Robotics Institute. They often simulate people or creatures, as you might expect to see in a science fiction movie as opposed to the much more common industrial robots welding Camrys today.)

Western culture prizes independent people, while in Japan the focus is on interdependence. People in independence-prizing cultures identify themselves as entirely separate from others, both in thought and deed.



They want to change their environment. Members of interdependent cultures aren't out to change the environment, but to work within it and fit into an existing social world.

Western "go-it-alone" robot developers create mechanical companions, each with their own particular characteristics. People in the West want to interact with their robots as they do with a valued colleague. Those associates have expressive faces, gestures, vocalizations, etc. Decision-makers want a robot to behave realistically, in the same independent way a human would in their culture.

In Japan, social robot developers aren't creating a teammate as much as soul mates, one that helps sustain humans emotionally. Although these robots provide emotional support, the Japanese value inferring psychological state from interaction in a situation as opposed to expressing it individually and directly. Noh masks convey information in the context of the plays in which they are used.

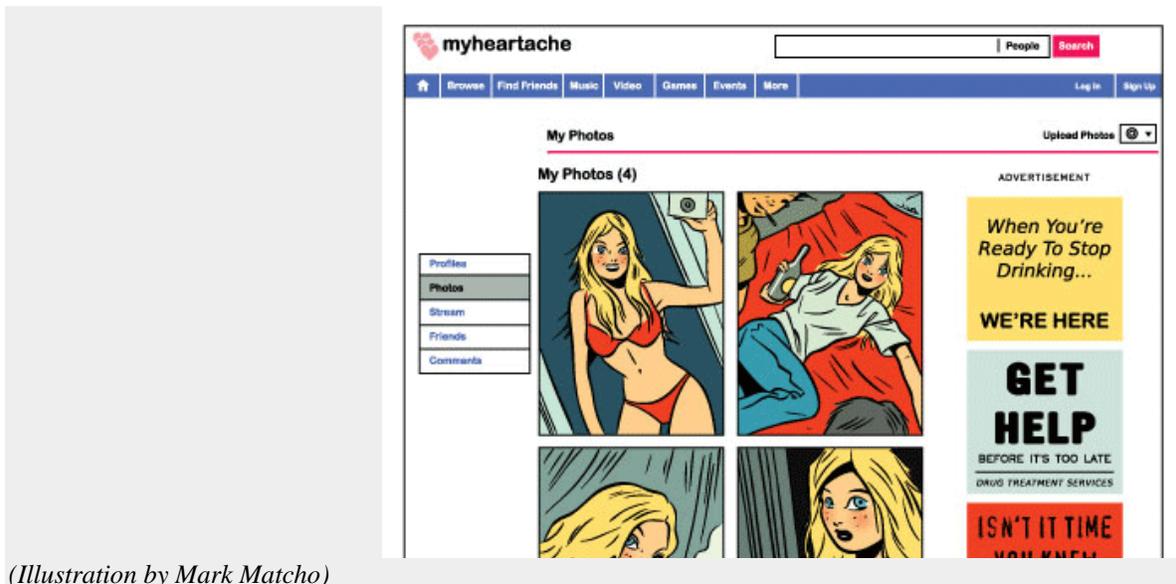
Independent teammates and interdependent soul mates seem as distinct as cheeseburgers and teriyaki. Once the marketing aces at the robotics firms on both sides of the Pacific go to work, we probably won't notice the difference.

<http://www.miller-mccune.com/science-environment/different-cultures-different-robots-23993/>

## When Facebook Is Your Medical Record

*Emerging research suggests kids' social network postings reflect their real-life behavior. Should that information be used in their medical care?*

By Jordan Lite



*(Illustration by Mark Matcho)*

Not long before some teenagers who'd been bullied on MySpace and Facebook started committing suicide in 2006, a doctor of adolescent medicine named Megan Moreno began hearing from her patients that social networking sites were making them sick. One girl started getting stomachaches after peers posted photos of her on MySpace. Another worried that the sexual references on her boyfriend's profile meant she'd have to do things she didn't feel ready for.

Moreno was troubled but intrigued: If MySpace, and more recently, Facebook, could so powerfully influence a teen's health for the worse, might the same information on the sites that was making teens ill — the prolific reports on their moods, drinking, drug use and sex lives — be harnessed to promote well-being?

Moreno got some firsthand, if anecdotal, evidence after she asked an especially reticent patient — a 16-year-old boy who suffered from headaches but insisted at each doctor's visit that he wasn't depressed — if they could look, together, at his MySpace page. "He had a lot of song lyrics on his page about depression and disclosures of pot use," says Moreno, an assistant professor at the University of Wisconsin-Madison. "There were references to him being a soccer player — which he never talked about — so we asked him what kind of player would he be if he were high and depressed. We figured out a plan to cut down his pot use, started him on an antidepressant and got him to see the connection between his pot use and his depression.

"Once he got that it was making the depression worse, he was really motivated to quit. His team went on to finals; he got most-improved player."

Moreno, of course, is hardly the only doctor interested in using social networking sites to improve people's health. Teens are a popular audience for these efforts, not only because they are among the least likely people to see a doctor, but because they use the sites voraciously (nearly three-quarters of teens and young adults are on a social networking site, according to the [Pew Internet & American Life Project](#)) and talk there about the very behaviors that are likely to put them in danger. But most medical efforts on the sites — namely health department ads and product profiles — are self-selecting, requiring users to deliberately seek out the medical information they “friend” or “like.” In contrast, Moreno, in her research, is going straight to the sites' users — in essence taking medical histories via their photos and status updates and asking a provocative question: Is what you're doing online a reflection of your health offline?

Do bacteria think? Is Facebook a medical record? Can we reform welfare reform? Check out those stories, our cover story on dealing with climate change through ocean carbon sequestration, and much more in the [November-December 2010](#) issue of *Miller-McCune* magazine.

Her early findings suggest it is. Research that Moreno presented at the [Pediatric Academic Societies](#) meeting this spring showed college freshmen with especially racy displays on Facebook (racy being “anything you wouldn't see at the beach,” she says) scored higher on a survey designed to measure intent to have sex for the first time than those with more reserved content. While she still has to compare specific online references to stress, violence and drug use to experience of those things offline, early data Moreno is collecting as part of a \$220,000 [National Institutes of Health](#)-funded study suggests that 16- to 20-year-olds' alcohol references on Facebook square with their real drinking habits. And research presented by Katie Egan, a Wisconsin nursing student who is collaborating with Moreno, found that the prevalence of stress references on students' Facebook pages lines up with survey data on the extent of stress among college students in general.

Though her results are scientifically important, Moreno is navigating complex ethical terrain. In 2008, Moreno and two colleagues mapped out a kind of how-to guide in [Pediatrics](#), arguing that social networking sites shouldn't be treated differently than any other research venue. Profiles set as “public” can't be reasonably thought of by their owners as private, they wrote, and permission to observe their content need only be sought if a scientist will be communicating with the owners or asking them to answer surveys.

But even if profile information accurately portrays a person, should doctors or college dormitory resident advisers make a habit of parsing their charges' profiles for signs of trouble? Should government agencies target specific users whose profiles suggest they're addicted to cigarettes or alcohol, or whose wild weekend might call for an STD test?

Egan was scheduled to conduct focus groups with college students late this year, asking them how they'd feel about being approached by a resident assistant who saw something on their profile that concerned them. But some doctors are wary of looking at patients' profiles, and not just because in many cases they'd have to “friend” them and therefore expose their own lives. The unannounced use of social media profiles “seems outside the bounds of the compact that exists” between physician and patient, says [Dr. Sachin Jain](#), who wrote about friending patients last year in the [New England Journal of Medicine](#). (Moreno says she only “occasionally” looks at her patients' profiles and always with permission.)

With the possible exceptions of mental health care, in which a doctor might see in a patient's status updates or photos signs of looming danger, or in pediatric care, when he says consent to look at a profile should be made jointly with kids and their parents, Jain doubts a profile review has “therapeutic value.” “There's this whole business of proactively seeking information about your patients — it's really quite problematic,” Jain says. “It raises equity issues, it raises validity issues. Occasionally people get curious about patients and Google them, sometimes finding out clinically useful information, sometimes finding information that's irrelevant and

potentially detrimental to the physician-patient relationship. We don't perform laboratory investigations or radiographic studies unless the patient knows what we're doing and why we're doing it. Including Googling and Facebook as part of your surveillance of patients strikes me as intrusive."

Indeed, much of Moreno's research these days involves probing teens' and young adults' feelings about being sought out via social networking sites for health outreach. A \$37,000 NIH-funded study is testing whether Facebook is an effective medium through which to screen female college freshmen for alcohol use. But the study is also asking participants how they feel about having their public profiles viewed by researchers. So far, Moreno says, participants seem annoyed that profiles they thought were private turned out to be public.

For a study she published in 2009, Moreno set up a "Dr. Meg" profile on MySpace, and then e-mailed teens who had publicly accessible profiles, explaining that as a doctor, she wondered if their posting sexual and other references was wise. She also noted that they might be at risk of contracting a sexually transmitted disease. The e-mail included a link to her university bio and another to free STD testing. Sexual references dropped by 13 percent among those who received the e-mail when she checked the profiles three months later (compared to 5 percent among those who didn't get it), and 10 percent who had received the e-mail switched their settings to private (as had 7 percent who hadn't gotten the note). Few people e-mailed back. Of those who did, half said they didn't realize strangers could be looking at their profiles.

"The other half," she notes, "said, 'Bugger off.'"

Ethics questions notwithstanding, there seems to be no legal impediment that would block doctors from looking at their patients' public social networking profiles. A MySpace spokeswoman said the company had no comment on the use of its site for health research or promotion. In a written statement, Facebook said that so long as researchers abide by the site's terms of service and privacy policy and obtained the consent of study participants, it "welcome[d] any organization that wants to promote health issues."

But there are real questions about the practicality of using those profiles.

Dr. Michael Rich, a pediatrician and director of Harvard's Center for Media and Child Health who calls himself "the mediatician," notes that the privacy and consent standards for research are much more stringent than they might be for daily medical practice. But he questions how realistic it would be for doctors to use profile information.

"Are you going to take every kid with a beer can on their profile and do an intervention on them? It's very dicey to make the leap from a picture to a behavior, and it's certainly not cost effective," he says. "Where's the time going to come from to cruise these sites and build a screening and an intervention around that?"

Still, there is an implicit assumption that a correlation between online and offline behavior exists and is useful information, acknowledges Ann Aikin, a social media strategist at the Centers for Disease Control and Prevention. The CDC buys ads on Facebook that are generated based on a person's demographic profile information and interests on the site. While targeted according to profile information, Aikin says, the ads are "expected" by social network users and therefore acceptable — unlike, she says, a government agency monitoring a site's "wall" conversations and promoting health behaviors based on their content.

Yet under the passive model by which public health agencies have tried to reach out, the results have been disappointing. In 2008, the New York City Department of Health and Mental Hygiene launched NYC Teen Mindspace, a MySpace page where teens could "friend" and follow the stories of avatars who were battling depression, stress and coping with dating violence. But the site has received only 113,000 page views. "You'd



hope for more,” admits Jeffrey Escoffier, the department’s director of health media and marketing. And since the agency added the phone number and e-mail for the mental health hotline LifeNet to the site in 2009, only 146 people have called or written for help.

City health officials have decided to repackage the Mindspace information on a dedicated teen health site, accessible from public school computers (MySpace and Facebook are typically blocked) and incorporate it into classroom discussions about mental health.

If a happy medium exists between respecting privacy and capitalizing on the health information social network users inevitably reveal, it likely will involve the use of existing network connections and the trust they have developed, says Jason Bonander, director of informatics at the CDC’s Chronic Disease Center. The agency’s campaign to increase awareness of HIV among young African Americans is trying to reach the Facebook and Twitter followers of actor Jamie Foxx and rapper Ludacris, many of whom reflect the CDC’s target audience of 18- to 24-year-olds, by encouraging the celebrities to send out CDC messages.

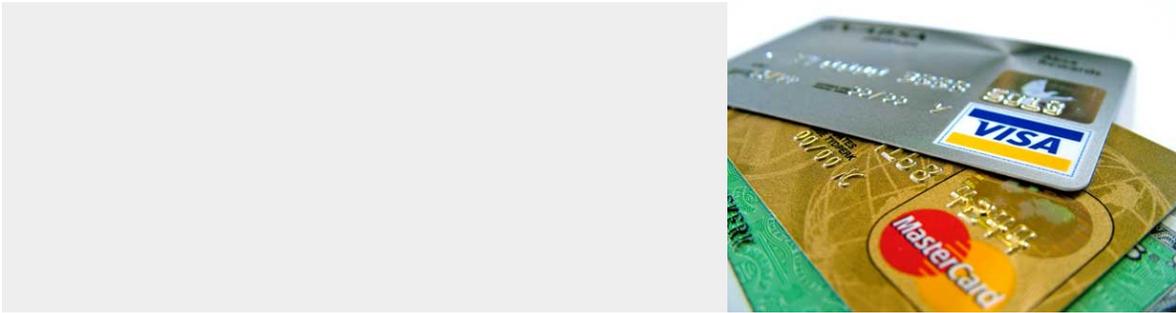
“If you identify an individual at risk for something, they’re sitting within a social network, and some part of that social network likely has the same risks,” Moreno says. “If we really could capture that idea that you could reach out on a website, not just to an individual but to their social network, that would be an unbelievable way to think about public health.”

<http://www.miller-mccune.com/health/when-facebook-is-your-medical-record-23607/>

## Threats to Self-Worth Spur Credit Card Use

*New psychological research finds credit cards make people more likely to bolster their fragile egos by purchasing luxury items.*

By Tom Jacobs



As a society and as individuals, we're still feeling the effect of the credit-fueled consumption binge of the past decade. While the dubiousness of digging ourselves into debt is now obvious, it's not clear what drove us to make so many foolish-in-retrospect choices.

Newly published research suggests part of the answer can be found in a deep-seated desire to prop up one's threatened feelings of self-worth.

Nathan Pettit of Cornell University and Niro Sivanathan of the London Business School report people whose feelings of self-value are endangered are more likely to purchase ego-boosting luxury items — but only if they have access to credit. Having the option of plunking down plastic minimizes “the psychological cost of payment,” making the transaction even more tempting.

Writing in the journal *Social Psychology and Personality Science*, the researchers contend the combination of “self-threat, product status and payment method creates a perfect storm” — one from which we're still mopping up.

Pettit and Sivanathan describe two experiments that provide evidence for their thesis. In one of them, 150 students were asked to write a short essay about either a pair of exclusive designer jeans (which put them in a high-status frame of mind) or a pair of normal, everyday jeans. They were then randomly informed that, based on the results of a test, their spatial reasoning and logical thinking abilities were either above or below normal.

Finally, the participants were asked whether they would purchase the jeans they described and how much they would pay for them. Half were told they'd be paying by credit card, while the others were informed they'd have to pay by cash.

“When credit was made available, participants receiving self-threatening negative feedback were both more likely to purchase high-status goods, and willing to pay a higher price for these goods than non-threatened individuals,” the researchers report. “In contrast, when cash/savings was the only option, participants

receiving self-threatening negative feedback were no more willing to purchase high-status goods, and paid no more for them than non-threatened participants.”

This indicates that “When individuals are under self-threat, and therefore seeking to repair their wounded egos, they increase their spending on compensatory high-status goods only when the psychological cost of payment can be minimized — i.e., paying with credit.” The “psychologically comforting embrace of credit” is a key part of the equation: Without it, the cost of bolstering one’s ego becomes obvious, and the allure of doing so is negated.

While these experiments measured laboratory responses rather than real-world behavior, Pettit and Sivanathan are currently collecting data comparing consumer spending patterns with large-scale threats, such as terrorism alerts and flu outbreaks.

Noting that many variables influence shopping behavior, the researchers are not ready at this point to suggest specific policy proposals. But they hope their insights will contribute to “the development of regulatory lending policies aimed at promoting healthy consumer behavior.”

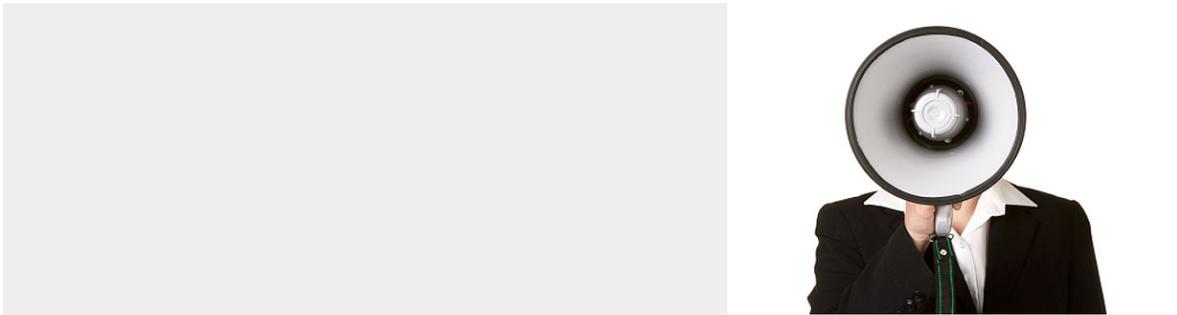
Their study suggests low self-esteem and easy credit can be a very costly mix. Ironically, your MasterCard may make you less of a master over your own imprudent impulses.

<http://www.miller-mccune.com/culture-society/threats-to-self-worth-spur-credit-card-use-24321/>

## Shouts Banish Doubts

*New research suggests one reason our political discourse is so loud and angry: Planting seeds of doubt leads people to more vigorously advocate for their cherished beliefs.*

By Tom Jacobs



*New research suggests that doubt can fuel an impassioned effort to advocate for one's beliefs even more strongly than if one had utter certainty of those same beliefs. (Clearviewimages / istockphoto.com)*

Two years ago, faith in free-market capitalism was badly shaken when the international banking system nearly collapsed. To many, a sober re-evaluation of the government's regulatory role seemed an inevitable response.

Instead, today's political discourse is largely driven by the Tea Party movement, which is impassioned and vocal in its defense of unfettered free-market capitalism.

Why have so many rallied in support of a system that recent events suggest is deeply flawed? Newly published research confirms and expands upon an insight first revealed in the 1950s: If confidence in one's core tenets becomes shaky, a common response is to proselytize all the more vigorously.

The apparent reason, according to Northwestern University researchers David Gal and Derek Rucker, is that advocacy on behalf of one's beliefs helps banish any uncomfortable lack of certainty.

"Although it is natural to assume that a persistent and enthusiastic advocate of a belief is brimming with confidence," they write in the journal *Psychological Science*, "the advocacy might in fact signal that the individual is boiling over with doubt."

The notion that shaken beliefs leads to increased levels of advocacy can be traced back to Leon Festinger's 1956 seminal book *When Prophecy Fails*. It examined a cult whose members believed in their leader all the more strongly and began actively advocating on his behalf even after his predictions of catastrophe failed to materialize.

Gal and Rucker set out to replicate Festinger's findings and use more recent psychological research to determine precisely what drives this dynamic.

They conducted three experiments. In one, 151 people recruited from an online database were surveyed about their eating habits. Their confidence level was manipulated by asking them to describe either two situations in which they felt considerable uncertainty, or two situations in which they felt a great deal of certainty.

They were then asked whether they were a vegan, vegetarian or meat eater and instructed to indicate on a seven-point scale how important their choice of diet was to them.

Finally, the participants were instructed to imagine they were discussing their food choices with someone who followed a different type of diet, “and to write what they would say to convince that person of the advantages of that diet.”

The result: Participants induced to feel doubt wrote longer messages and spent more time writing them than participants induced to feel comfortable. This effect was particularly strong among those who viewed their dietary preference as very important to them; it disappeared altogether among those who considered diet unimportant.

In both this and a second experiment, “individuals induced to feel doubt about their beliefs exerted more effort toward advocating beliefs,” the researchers write. A third study, which looked at Mac and PC users, found the doubtful also “expressed a greater likelihood to attempt to persuade other people of their beliefs.”

This helps explain why political rhetoric has ratcheted up during a time of rapid societal change. In a logic-driven world, the shattering of long-held assumptions such as “the U.S. will never be attacked on its home soil” or “the value of my house will never decrease” would lead to a thoughtful period of reflection and re-evaluation. In our world, it leads one to actively advocate one’s pre-existing beliefs all the more passionately.

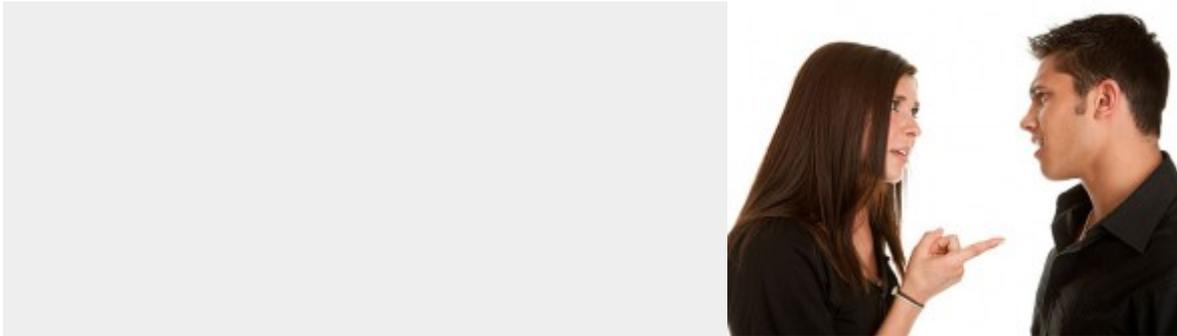
So, in contrast with conventional wisdom, the Tea Partiers may not be true believers so much as they are people who have had their confidence in the system shaken. To overcome any distressing doubts, they have reaffirmed their convictions by loudly attempting to persuade others. As Gal and Rucker put it in the title of their paper: “When in Doubt, Shout!”

<http://www.miller-mccune.com/culture-society/shouts-banish-doubts-24157/>

## Accusations of Sexism Spur Greater Sensitivity

*New research finds confronting a man about his sexist language can have surprisingly positive results.*

By Tom Jacobs



*Confronting a man about his sexist language can change his behavior in a positive way, new research suggests. (Jody L. Matthews / istockphoto.com)*

A woman who bristles when a male friend or colleague uses sexist language has to make a quick decision: Call him on it, or not? Although she might be personally offended, she may be reluctant to speak up, anticipating his response will be dismissive or defensive.

Research just published in the *Journal of Experimental Social Psychology* suggests such fears may be overblown. It describes a carefully structured study in which college-age males are confronted over the use of sexist language — and respond with heightened sensitivity regarding gender issues.

“Confrontation reduces the future occurrence of biased behavior,” write the study’s authors, psychologists Robyn Mallett and Dana Wagner of Loyola University Chicago. “If [a man who is challenged after expressing a sexist statement] is motivated to be liked by the confronter, or wishes to present a non-prejudiced image, then he will likely compensate in response to confrontation and change his future behavior.”

Their three-part study featured 109 college-age males. In the first section, each participant entered into a conversation with a female about an ethically ambiguous scenario. Their talk was engineered to include a confrontation. For half the men, this exchange had nothing to do with gender; for the other half, it revolved around their alleged use of sexist language.

Specifically, as they discussed whether a nurse should be fired, the woman said with some annoyance, “I noticed that you said ‘she’ when referring to the nurse. Are you assuming the nurse is female? That’s kind of sexist, don’t you think?” (She made this accusation whether or not the man had actually used the term “she.”) Two research assistants — one male, one female — observed the man’s reaction, noting both verbal and nonverbal responses.

After that discussion concluded, the couple went on to a second round in which they discussed two topics, one of which involved gender issues (such as funding for women’s sports). The research assistants noted any “compensatory behaviors” on the part of the man, such as smiling, making eye contact and “putting a lot of

thought” into his answers. Afterwards, the man reported the extent to which he liked his female counterpart and his perception of whether she liked him.

Finally, each man took a test in which he was asked to correctly identify three types of errors in 30 sentences. These ranged from spelling and grammar to sexist language such as using “he” or “his” when referring to all people. Before the test began, the men received specific instruction regarding what constitutes sexist language.

The results: “We found that a second conversation, which involved gender-relevant topics, went just as well if the man had been confronted a few minutes earlier for using sexist language,” the researchers report.

The men who were confronted for their alleged sexism engaged in more compensatory behaviors — everything from outright apologies to emotion-based body movements such as leaning back or forward. These efforts, perhaps surprisingly, “paid off in the form of mutual liking,” according to Mallett and Wagner.

In other words, the confrontation shook them up, but not in a negative way: They described a more cordial relationship with their partner than those men who were spared the sexism accusation and resultant agitation.

What’s more, “confrontation and mutual liking were both positively associated with sexist language detection,” the researchers write. “Men experienced more mutual liking with their confronter after the sexist confrontation, and that mutual liking increased their subsequent detection of sexist language.”

The researchers caution that the “generalizability of these effects across social groups, and with different types of confrontation” still needs to be tested. Indeed, it’s quite possible that screaming “sexist pig!” would be counterproductive.

Moreover, it’s unclear whether the reaction of male college students would be mimicked by, say, workers at a construction site. Mallett and Wagner conclude men are constrained from using sexist language by “social forces” and a desire to appear unprejudiced. If so, their behavior would presumably be impacted by the level of sexism considered acceptable in their social sphere.

Nevertheless, the study should bolster the confidence of women in professional situations who have been reluctant to speak their minds. According to this research, men — at least under certain circumstances — respond better to criticism than anyone suspected.

<http://www.miller-mccune.com/culture-society/accusations-of-sexism-spur-greater-sensitivity-23794/>

## Chicago Kids Take on Bunker Mentality, No 'Friends'

*Pre-teens living in high-crime neighborhoods avoid making friends, a University of Chicago pilot study has found.*

By Melinda Burns



*Researchers were shocked to learn that a kind of "bunker mentality" held sway at both Chicago-area schools they studied. (Spauln/istockphoto)*

In violent neighborhoods of Chicago, children on the brink of adolescence are so fearful of their safety that they don't form stable friendships at school. Many don't even use the word "friend."

They say they have "associates."

At age 13 or 14, they define a best friend as someone who "always has my back" and "sticks up for me a lot" and will not run away if the "raper-man" comes. They watch their fellow classmates for a long time, even staging loyalty tests before deciding whether to get closer.

These youngsters do not talk in terms of, "You like computer games, I like computer games"; or "You like soccer, I like soccer," and we become friends," said Mario Small, a University of Chicago sociologist who

oversaw interviews with 44 students, ages 11 to 15, at two of the city's predominantly African-American, high-poverty elementary schools in 2007 and 2008.

"There was almost none of that," Small said. "They had an extremely strategic and really disturbing way of thinking about friendship. Most of them understood their friendships in terms of the violence in their neighborhoods."

Small and Anjanette Chan Tack, a University of Chicago graduate student in sociology, originally designed their pilot study to compare the effects of student body turnover on friendships among children. They chose two elementary schools in Chicago, one with a high turnover rate and another with a stable student population. Two researchers, including Chan Tack, interviewed students in-depth over the course of one academic year.

Small said they were floored when they found that a kind of "bunker mentality" held sway at both schools, even to the point that the children, both boys and girls, routinely tested their peers and were conducting "background checks" to see whether they could be trusted, cross-checking their dependability with classmates and watching them for months and years.

"It sounded like a warlike situation," Small said. "I really don't want to sensationalize this. But, frankly, it is so pervasive among our interviewees and so powerful that I don't think the analogy is inappropriate. Violence is pervasive in the poorest neighborhoods of Chicago. There are lots of pretty serious beatings, and the 13- and 14-year-olds are already starting to become victims. At this age, the children are still learning how to negotiate their neighborhoods on their own."

One girl said she invited a classmate to a party and staged a fight with someone else to see if the classmate would intervene to defend her. Another girl, a seventh-grader, said she planted false gossip with people she was "watching" in order to test them. If she heard the gossip going around, then she knew those people were not her true friends.

You "start knowing you don't need many friends," a 15-year-old said. "You have friends but don't let them in too close, unless you've been with them forever. Somebody you just met two years ago, nn-mm, don't let them in too close..."

Those attitudes come amid a reduction in the city's most violent crimes.

Chicago Police Department statistics show that violent crime dropped by 4 percent between 2007 and 2009, and sexual assaults and aggravated assaults dropped 9 percent. From January to July this year, violent crime dropped nearly 11 percent compared to the same period in 2009.

But a Chicago Tribune poll taken in July, a day after a police officer was killed, found that only 30 percent of Chicagoans feel their neighborhoods are safe.

Small and Chan Tack presented an unpublished draft of their study in May at the annual meeting of the American Education Research Association, held this year in Denver. Small talked about it in a podcast for *The Annals of the American Academy of Political and Social Science* in June. He said wanted to expand the study to the entire Chicago school system because it covers a subject "we have ignored for too long."

As if the findings aren't tragic enough, Small told Miller-McCune.com, he is worried about the children's ability to form trusting bonds with people as adults. The pre-teen years are typically the formative time when

children learn how to make friends, trying different approaches. But in violent neighborhoods, Small said, children are forced to grow up faster and be more guarded.

“I’m really concerned about this not merely for the present but for the future trajectory of these children,” Small said. “They are going to have trouble negotiating romantic relations and relations with their bosses. It’s going to take a while for them to open up and be trusting.”

And the effects could be multi-generational. In interviews with 16 parents of children in the two Chicago schools, Small’s team found that the adults, many of whom grew up in violent neighborhoods themselves, consistently passed on their survival strategies to their children.

“If you have generation after generation of children growing up like this, it can be a cycle where it can perpetuate itself,” Small said. “As a society, it’s unhealthy. A population so consistently exposed to violence can be one of the clearest indicators of inequality.”

In 1993, a survey of more than 500 children in three elementary schools on Chicago’s South Side found that 26 percent had witnessed a shooting, 30 percent a stabbing and 78 percent a beating. Crime has been trending downward in the city since then, mirroring national trends, but some districts are more crime-ridden than others. One of the schools in the University of Chicago study was among the top five districts for murder in Chicago in 2007, and the other school was next to two of the top five districts.

A 14-year-old boy who was interviewed put it this way: “You gotta watch where you walk out here. You can’t walk up to that gas station by yourself. You can’t go to the park by yourself. . . . Can’t even walk to the library without getting jumped. I walked to the library, I got jumped. Just ’cause I wanted to go read a book I got jumped.”

A 13-year-old girl who said she wanted to be a lawyer told researchers that after a stabbing across the street from her home, “I felt more scared than I already was. I really still won’t go outside, because I’m scared stuff is going to happen to me, so I stay in the house and I read and I talk to my friends on the phone.”

School didn’t feel safe, either. One eighth-grade boy who got into a fight at school about once a year described how fights would start:

“People might not like people looking at them,” he said. “So they’ll say something, and everybody gets to talking back and forth, and back and forth, and they just end up fighting. The maximum time for you to look at somebody in this school is about four or five seconds.”

To cope with the unpredictability and the proximity of violence, from school bullies and from strangers, the children seemed to be trying out a number of different things, Small said. This finding ran counter to previous studies, which had suggested that children confronted with violence usually chose either to withdraw or seek protection.

In his study, Small said, nine out of 10 of the children said they would not start fights, but many said they were willing to finish them. Some relied on their cousins for help or turned to older teens for protection. Some instigated fights just to make sure they were not “disrespected.” Some tried to cultivate people who were good at helping them diffuse conflict while saving face, the kind of people who, if you were insulted, would say, “Just let it go, don’t worry about it.” And many avoided investing emotionally in friendships altogether.

One eighth-grade boy recalled how he got burned when he got into a car with some other boys without knowing the car was stolen. They all got arrested and locked up, the boy said, so now “I ain’t been trying to make friends.” When asked to name the most important people in his life, he said, “My family. That’s it. I ain’t never wanted a best friend. I just talk to people. I don’t try to make friends with them. ... ‘Cause I don’t know if they real friends or not.”

One sixth-grade girl who appeared sociable and loquacious in school revealed a warier side when it came to emotionally engaging with people. Though she played on several sports teams, she said she did not know anyone very well.

“The reason is, I don’t want them to know me,” the girl said. “All they know about me is my mom is a teacher and I’m 11 and I’m in their class and that’s all. ... I like to keep it that way, because I don’t like people to know my business as it could spread.”

This girl reported having a best friend at school, but said she had never asked her for her phone number. “I would prefer her to be at school,” she said. “I like to be at peace on the weekend. I don’t really like to talk to people. I like to be by myself. That’s who I kind of am.”

“Our children are in some of the most violent crime neighborhoods in the city,” Small said. “All it takes is one series of assaults in a park for the young girls to be worried about the raper-man for a couple of years. The thing about the violence here is you don’t know when it’s going to happen, but it has happened recently enough and near enough that you would be irrational not to be alert.”

<http://www.miller-mccune.com/culture-society/chicago-kids-take-on-bunker-mentality-no-friends-23798/>

## Baby's Must-See TV Does Not Increase Vocabulary

*Researchers find that infant media does not expand vocabulary*

By Jessica Hilo



*The Teletubbies tried really hard, but ultimately, research shows, educational television aimed at children under 4 doesn't actually increase the vocabulary of the toddler set. (BBC)*

In 1997, the BBC launched Teletubbies, a controversial education program aimed specifically at children under the age of 4. In a bid to win over its presumed audience, the show affixed its main characters with the body proportions, behavior and language of infants. It became a critical and commercial success, despite occasional silliness surrounding one Teletubby character and another: the Rev. Jerry Falwell.

The First World spends generously on infant media. Four years after the Teletubbies debut, The Walt Disney Co. bought the Baby Einstein Company, founded by a former teacher in Georgia, for \$25 million. It now represents 90 percent of the baby media market in the United States, a market worth a reported \$200 million.

Despite widespread popularity and a lively exchange over the benefits of playing classical music to young'uns, there has been little scientific evidence on the benefits of infant media. Only a few studies have focused on infant relations with early television exposure; and of those, few have specifically focused on infants' learning something directly from the media. A new study in the journal *Psychological Science* examines this learning curve.

Researchers from the University of Virginia and Vanderbilt University tested 72 infants aged 12 to 18 months for how many new words they absorbed after repeated viewing of a popular educational DVD.

The infants were screened for vocabulary prior to testing and assigned five to 12 unique target words that they were required to learn from the 39-minute video over the span of four weeks. Researchers conducted the experiment in the subjects' homes and under conditions that mimicked typical viewing experiences.

A third of the participants viewed the video with parental interaction. A parent watched the DVD with the child at least five times a week for a total of 10 or more hours of viewing time. A second group of participants viewed the DVD for the same period of time, but were left alone (parents were in the room, but not watching television with their children). A third control group was used to measure an infant's learning without the use of an educational video, but through natural parental interaction. All parents were asked to complete a log of their child's development as the experiment progressed.

After four weeks, participants were screened for enhanced vocabulary. The subjects were shown pictures, some representing their target words and others intended to distract their focus. They were then asked to identify the picture containing their target words. Each participant ran through testing twice to ensure that he had actually "learned" the target words.

Researchers found that the children did not learn any more words from their month-long exposure to the educational DVD than their control counterparts. In fact, the highest level of learning occurred in a no-video environment in which parents taught their children target words during everyday activities.

Earlier this year, our Erik Hayden reported that the amount of television had little discernible impact on children aged 5 to 10. While it's comforting to know that the idiot box is truly not an idiot-maker, it is disheartening to discover that the old video babysitter isn't making our children any smarter, either.

<http://www.miller-mccune.com/education/babys-must-see-tv-does-not-increase-vocabulary-24301/>

## how to delete corporate logos from view

- 16:02 22 October 2010 by **MacGregor Campbell**

*Innovation is our regular column in which we highlight emerging technologies and predict where they may lead*

Call it advertisement hacking. Technology-inspired artists have designed ways for you to mask or perhaps even delete company logos in your field of view as you wander around a city or shopping centre.

The trend subverts a technology called augmented reality (AR), by which virtual information – say restaurant ratings – is overlain on the real world as you peer through smart glasses or a smartphone camera. New York artist Jeff Crouse has designed a program called Unlogo, which detects corporate logos in a video stream, then replaces them. The software uses a computer-vision system, normally used in robotics, to learn to recognise logos at different angles and in varied lighting. His current prototype overlays a logo with a photo of that company's CEO.

The project is still under development and does not yet run in real time, but Crouse's goal is to produce a video filter for removing logos from, say, home movies.

### **Worrying acceptance**

Another project, called "Artvertiser", augments ads in a visual display with works of art. It's a pair of binoculars containing a camera, a display, and a processor running image-processing software. "We're so used to seeing these billboards in our cities, that we've almost come to accept that it's kind of a natural state, and I think that's something to worry about," the project's designer Julian Oliver, an artist based in Berlin, Germany, told the TEDxRotterdam meeting in June.

Another New York-based artist, Mark Skwarek, is using AR to make a political point about the Gulf of Mexico oil spill. The Leak in your Home Town is a smartphone app that overlays an animation of a leaking oil pipe over BP logos in gas stations or on billboards.

His project website describes it as a kind of benign graffiti: "This repurposing of corporate icons will offer future artists and activists a powerful means of expression which will be easily accessible to the masses and at the same time will be safe and non-destructive."

### **Diminished reality**

Jan Herling at the University of Technology in Ilmenau, Germany, has taken such visual augmentation a step further, with software that deletes objects altogether from a video feed. It's not specifically for deleting logos, but it's easy to see how it could be applied in that way. In one demonstration of the technology, a Mercedes logo is removed from a vehicle's hubcap.

Peering through a tablet computer's camera, a user selects an object to remove – a stapler on a desk, say – and Herling's software removes it, in real time, from the tablet display. It works by removing the selected object, then intelligently enhancing frames back to "normal" by filling in removed space. Herling calls it "diminished reality". "We think that there are thousands of applications," he says.

<http://www.newscientist.com/article/dn19616-innovation-how-to-delete-corporate-logos-from-view.html>

## Vaccines could help elephantiasis spread

- 23 October 2010
- Magazine issue [2783](#).



Worm vaccine may help the one but harm the many (Image: Frederic Courbet/Panos)

PARASITIC worms can adjust their survival strategy based on their host's immune response. This means potential vaccines against elephantiasis might make the infection spread more easily through communities. Elephantiasis infects 120 million people a year in Africa and Asia. Tiny filaria worms carried by mosquitoes block the lymph vessels that normally drain fluid from limbs or genitals, which then swell to grotesque proportions. The only prevention is a yearly dose of worming drugs, but fewer than half the people at risk receive them.

Work is under way on a vaccine, but Simon Babayan at the University of Edinburgh, UK, and colleagues, have discovered that some vaccines may make the worms worse. When filaria worms in mice sense that the mouse is mounting a strong immune reaction, they change their life cycle, producing more offspring in the blood earlier. This helps the worm ensure that it will be picked up and transmitted by another mosquito despite the immune attack (*PLoS Biology*, DOI: [10.1371/journal.pbio.1000525](https://doi.org/10.1371/journal.pbio.1000525)).

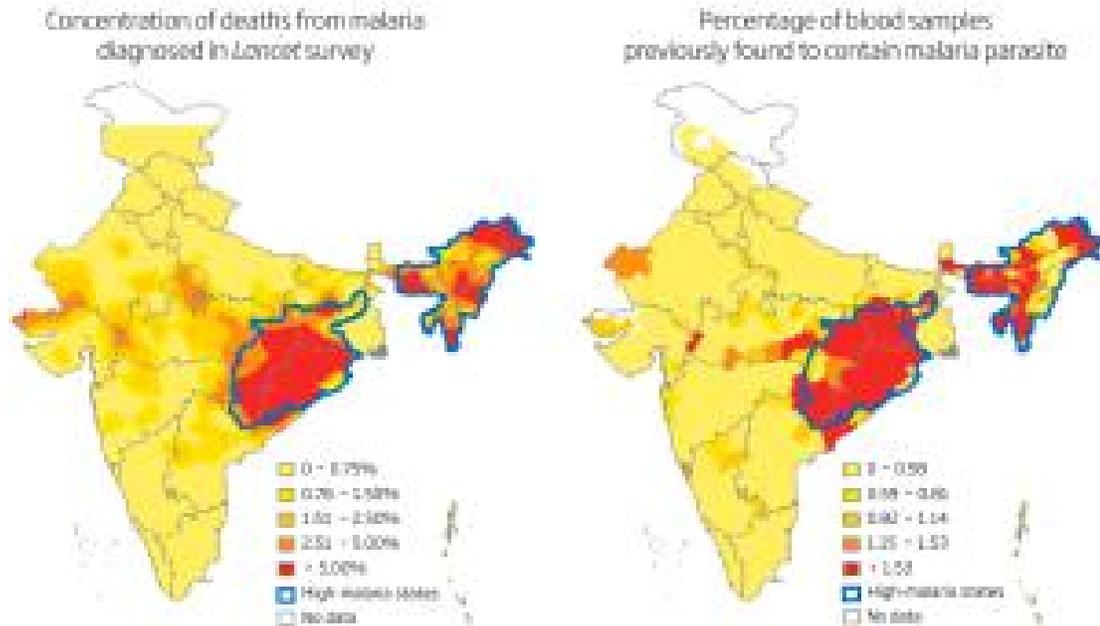
Unfortunately, experimental vaccines rely on the very immune reactions that warn the worms, Babayan says. People who get such a vaccine may defeat their own infection, but the worms' early response means they will pass on more infections.

Babayan says potential vaccines should be tested for whether their targets adapt to them in this way.

<http://www.newscientist.com/article/mg20827833.200-vaccines-could-help-elephantiasis-spread.html>

## Malaria deaths in India 10 times as many as thought

- 18:07 22 October 2010 by **Debora MacKenzie**



The location and timing of malaria deaths diagnosed in the Lancet study match the pattern previously found in a study of blood samples, suggesting that the diagnosis is accurate. Other fevers were found to have different distribution patterns

India's malaria map

Malaria has always been one of humanity's **biggest killers**, but it may be far bigger than we realised. An unprecedented survey of the disease suggests that it kills between 125,000 and 277,000 people per year in India alone. In contrast, the World Health Organization puts **India's toll** at just 16,000.

Other countries using similar accounting methods, such as Indonesia, may also be underestimating deaths from malaria. That means it could be killing many more than the **WHO's official estimate** of nearly 1 million people a year worldwide, suggesting more money should be spent to fight it.

Estimates of malaria deaths in India are based on death rates recorded in clinics. They are corrected in an attempt to account for people missed by the health system, but a new study by an international team of researchers has found that these numbers have been vastly underestimated. This is partly because so many cases never make it to a clinic and because these people are more likely to die than those that get medical help.

### Word of mouth

The researchers behind the survey include a group from the **Centre for Global Health Research** at the University of Toronto, Canada, which is collaborating with the Indian government on the **Million Death Study**, surveying 1.1 million households across India to improve the country's health statistics. That includes gathering "verbal autopsies", in which householders describe how family members died, to count deaths that were never officially diagnosed.

Each verbal autopsy was diagnosed by two local doctors. Their interpretation was the main source of potential error in the malaria study, says co-author **Richard Peto** of University of Oxford. However, the location and timing of the malaria deaths diagnosed matched the expected pattern for malaria but not for other feverish illnesses, suggesting they were accurate ([see maps](#)).

To estimate malaria's yearly death toll, the researchers applied the percentage of deaths from malaria in the survey to the total number of deaths in India. When they included only the most certain diagnoses, in which



both doctors immediately fingered malaria, the toll was 125,000 a year. Adding cases in which only one doctor diagnosed malaria raised the total to 277,000. The most likely toll, they conclude, is around 200,000.

#### **Lessons from Africa**

"When we've done studies of malaria control in Indian villages, we've seen so many really nasty cases of the disease that I always wondered why the official estimate was so low," says Peto. "Malaria deaths happen out in the countryside. They're invisible to the healthcare system."

Bob Snow, a malaria epidemiologist with the University of Oxford's research programme in Kenya, says the results suggest that some of the methods being used to fight malaria in Africa might work in India too. "Some states are not enormously different to what we see in highly malarial areas in Africa, suggesting universal coverage with insecticide-treated bed nets and access to prompt treatment will be cost-effective."

Snow says he is not surprised the study found more malaria deaths than the official estimate, but calls it "startling" that as many as 86 per cent never saw a doctor. "India has a space programme but cannot provide prompt access to malaria treatment in Orissa state [where deaths are highest]," he said. "This study will surely be a wake-up call."

Journal reference: *The Lancet*, DOI: 10.1016/s0140-6736(10)60831-8

<http://www.newscientist.com/article/dn19619-malaria-deaths-in-india-10-times-as-many-as-thought.html>



## Formula for the perfect marathon carb load

- 13:28 22 October 2010 by **Jacob Aron**
- 

Marathon runners need never "hit the wall" again thanks to a mathematical model that will help them reach the finish line in their best time.

More than 40 per cent of marathon runners will hit the wall during a race, experiencing sudden pain and fatigue as their carbohydrate reserves run low and their body switches from burning carbohydrate to burning fat. So **Benjamin Rapoport** at the Massachusetts Institute of Technology has given runners an online calculator that will tell them how much carbohydrate they need to consume to have enough for a whole race. Carbohydrates release energy faster than does fat, but we can carry only limited supplies, stored in the liver and muscles. Once they reach critical levels our bodies switch to fat reserves, which are more energy-dense but a less efficient power source. When this happens, by-products from the fat metabolism build up in the body, often causing the excruciating pain of hitting the wall.

Endurance runners try to avoid this transition by **loading up on carbs** before a race, but until now individual athletes have relied on intuition to gauge how much they need to complete a marathon.

### Calorie count

Rapoport hopes to give them hard data instead, with numerical estimates of the carbs they need. His model, **which is available online**, first lets runners estimate their maximum aerobic power or  $VO_2$  max – a measure of the rate at which oxygen is transferred to muscles.

By comparing that figure with their body weight, age and chosen marathon completion time, runners can work out the total amount of carbohydrates, measured in kilocalories that they will need to consume to achieve their goal.

Some runners will not need to bulk up on carbs because their leg muscles store enough energy anyway. But for some, it is time to stock up to avoid a mid-race slump.

**James Betts**, an exercise nutritionist at the University of Bath, UK, says Rapoport's conclusions compare well with running data gathered in the lab, but runners must also take into account the efficiency of the carbohydrates they consume. "Recent work has shown that different carbohydrates can be used at different rates," he explains.

Though Rapoport's model may help amateur athletes improve their race times, British Olympic marathon runner **Liz Yelling** prefers to set her own pace. "It's about trying to push boundaries at my level, almost trying to beat science," she says. "But less experienced people need the confidence that what they're aiming for is a realistic target."

Journal reference: *PLoS Computational Biology*, DOI: 10.1371/journal.pcbi.1000960

<http://www.newscientist.com/article/dn19614-formula-for-the-perfect-marathon-carb-load.html>

## Alzheimer's protein can move from blood to brain

- Updated 16:20 22 October 2010 by **Jessica Hamzelou**

Neurologists have found that the brain plaques associated with Alzheimer's can form when the proteins responsible are injected into the bellies of mice, suggesting that the guilty proteins can get from the body's periphery to wreak havoc in the brain.

A protein called beta-amyloid makes up the brain plaques that accompany the disease. In 2006, Lary Walker at Emory University in Atlanta, Georgia, Mathias Jucker at the University of Tübingen in Germany and colleagues found that they could trigger Alzheimer's-like plaques by injecting samples of plaque-ridden brains into the brains of healthy mice. Now, Jucker and his colleagues at Tübingen have managed to create the same brain plaques by injecting the tissue elsewhere in the bodies of mice.

### Mouse models

The group used mice genetically modified to produce large amounts of beta-amyloid, meaning they develop brain plaques similar to those seen in Alzheimer's disease in people. When the mice were around 2 years old, the team removed some of their beta-amyloid-laden brain tissue and injected it into the peritoneum – the lining of the abdomen – of young transgenic mice. Another group of transgenic mice received an injection of healthy brain tissue from normal mice of the same age that had not developed plaques.

Seven months later, before the mice had had a chance to develop plaques of their own accord, the team looked at their brains. The mice injected with healthy brain tissue had normal-looking brains, but those injected with beta-amyloid-heavy tissue had developed full-blown plaques similar to those seen in people with Alzheimer's.

If beta-amyloid in a mouse body's periphery can cause plaques in its brain, could Alzheimer's be transmitted by blood transfusions in humans? There's no evidence to suggest this might be the case, says Jucker. "We don't know if misfolded beta-amyloid can get out of the brain and into the bloodstream, for a start," he says. Paul Salvaterra, a neurologist at the City of Hope hospital in Duarte, California, points out that Jucker's team only use an indirect measure of Alzheimer's because they focus only on plaques – just one aspect of the disease. "These authors are not studying Alzheimer's disease and certainly not studying infectious Alzheimer's disease," he says. "The type of [disease] they show is only suggestive of some aspects of Alzheimer's disease-related changes in the brain."

The early findings don't yet have implications for the general public, says Jucker, though he cautions that researchers should take care when handling amyloid proteins.

Journal reference: *Science*, DOI: 10.1126/science.1194516

<http://www.newscientist.com/article/dn19607-alzheimers-protein-can-move-from-blood-to-brain.html?full=true&print=true>

## Bill Gates's road map for saving 4 million lives

- 18:35 21 October 2010 by [Andy Coghlan](#)



Radical reduction in child deaths is in sight (Image: [One.Org](#))

Philanthropist and Microsoft founder Bill Gates this week unveiled [his favourite image](#), as he launched the "[Living Proof](#)" campaign to bolster support for development aid to poor nations.

After rejecting paintings by van Gogh and Leonardo da Vinci – and even the Microsoft logo – Gates revealed that he had plumped for a graph showing that between 1960 and 2008, the number of children dying each year fell from 20 million to 9.3 million.

Making the case for aid, Gates and his wife Melinda listed numerous successes through vaccination, education and agricultural programmes over the past decade.

Melinda Gates said that efforts to combat corruption through careful auditing of funds were working.

Problems of "aid dependency" are being reduced though "smart aid" that helps recipients to escape poverty through their own efforts, she said. "The overall trend is that the world is getting better and better, although maybe not fast enough."

### 15-year target

Bill Gates said his aim for the next 15 years is to see child deaths cut to 5 million per year.

This will be achieved by dispensing more bed nets and anti-malarial drugs, deploying more trained birth attendants, and supplying new vaccines to combat lung disease, and diarrhoea caused by rotaviruses. "It's a road map for saving more than 4 million lives a year by 2025," he said.

To ram home the message that aid has rapidly improved lives for the world's poor, the pair said that since its creation in 2002, the [Global Fund to Fight AIDS, Tuberculosis and Malaria](#) has supplied anti-retroviral drugs to 2.8 million people with HIV, diagnosed and treated 7 million cases of TB and distributed 122 million bed nets. The nets halved malaria cases in Rwanda, Cambodia and Zambia, and reduced incidence by 76 per cent in the Philippines.

Through the [Global Alliance Vaccines Initiative](#), vaccines have reduced tetanus cases by 85 per cent, and diphtheria and measles by 93 per cent in 10 years.

There is also progress supplying nursing care to help pregnant mothers and their babies safely through childbirth, another unserved need that claims 300,000 lives each year.

### Community links

Melinda Gates said that since 2003, 15,000 regional health centres have opened in Ethiopia alone, employing 35,000 healthcare workers. "They live out in the communities themselves," she said, adding that this is a pivotal factor that has helped to drive down child mortality in Ethiopia by 25 per cent since 2003.



In agriculture, aid and research are helping to boost productivity through targeted interventions aimed at improving crop yields, capturing water for irrigation and providing advice on selling surplus produce. "We can cut hunger in half in Africa by 2020," said Bill Gates.

Overall, the programme of research, innovation and "smart aid" is helping families to lift themselves out of poverty, said Melinda Gates. "If you protect your children through vaccination, it protects the whole family, as parents don't have to care for sick children and can go to work, so they then have more to spend on their children's education and future."

Vaccination also counters unsustainable population growth, Melinda Gates said. "When they're confident their children will make it past their 5th birthday, parents have fewer children."

<http://www.newscientist.com/article/dn19608-bill-gates-road-map-for-saving-4-million-lives.html>





## Low levels of vitamin B<sub>12</sub> linked to Alzheimer's

- 15:24 21 October 2010 by **Miriam Frankel**

People with low levels of vitamin B<sub>12</sub> may be at greater risk of developing Alzheimer's disease. The finding supports previous research showing large doses of B vitamins might halve the rate of brain shrinkage.

Babak Hooshmand and colleagues at the Karolinska Institute in Stockholm, Sweden, followed 271 healthy people aged 65 to 79 for seven years. The researchers measured the blood concentration of the amino acid homocysteine, high levels of which have been linked to negative effects on the brain, such as stroke. They also measured levels of active vitamin B<sub>12</sub>, which can decrease homocysteine levels.

By the end of the study, 17 people had developed Alzheimer's. A level of homocysteine moderately above average corresponded

to a 16 per cent higher risk of developing Alzheimer's, while a level of active B<sub>12</sub> slightly above average meant a 2 per cent lower risk.

"This is a very convincing study," says David Smith of the University of Oxford, who has investigated the effect of B-vitamin supplements on brain shrinkage. He says it is the first to show that low levels of active vitamin B<sub>12</sub> are a risk factor for developing dementia several years later.

Although B<sub>12</sub> deficiency is common among elderly

people, more evidence is needed before recommending B<sub>12</sub> supplements to stave off dementia, says Hooshmand.

Journal reference: Neurology, vol 75, p 1408

<http://www.newscientist.com/article/dn19184-low-levels-of-vitamin-b12-linked-to-alzheimers.html>



## Universal flu vaccine one step closer

- 15:09 21 October 2010 by **Debora MacKenzie**
- 

Feeling stuffy and miserable? Forgot your flu jab this year? What you need is a vaccine that will stop flu once and for all – and prospects for one have just got brighter.

A protein touted as flu's Achilles' heel when it was discovered last year has now been tested as a vaccine, and it worked, at least partially, against every version of human flu.

People need to be vaccinated against flu every year. This is because the flu virus is a scam artist: it uses a big, showy surface protein to attract your immune system, then changes it so your immune system won't recognise it next time round. Vaccines must change yearly to match it.

Worse, there are 16 different varieties of this protein, called Hemagglutinin (HA), and immunity to one doesn't work on the others. Pandemics happen when flu swaps one for another, as swine flu did last year.

If we could identify a flu protein that the virus can't alter so readily, then we should be able to elicit immunity that recognises all kinds of flu.

### Mushroom stalk

Last year, two groups reported a promising candidate: part of the stalk of the mushroom-shaped HA, a vital bit of viral machinery which doesn't vary much over time or between viruses.

One of those groups, at Scripps Research Institute in La Jolla, California, teamed up with Peter Palese and colleagues at Mount Sinai Medical School in New York to test that protein as a vaccine. They report that 54 amino acids from this bit of the stalk, linked to a protein that attracts immune reactions, induced antibodies that work against viruses from every flu family that attacks people.

These included three pandemic viruses (H1, H2 and H3), three others that attack occasionally (H6, H9 and H7), and the H5N1 bird flu from 2004 – albeit modified to make it less deadly.

Mice were injected with this protein twice, three weeks apart, to allow their immunity to develop. Two weeks after the second injection each mouse was exposed to one type of live flu virus, as were unvaccinated mice.

The team found that doses of the viruses that killed unvaccinated mice did not kill any vaccinated mice – except for the H5N1 virus, and then more than half the vaccinated mice survived.

Vaccinated mice still became ill, but not as ill as unvaccinated mice, judging from the weight they lost, a standard measure of illness in mice.

### Partial protection

So the vaccine didn't protect the mice completely, but it would be cheap and quick to make, and could stop people dying, the team say – which might be enough in a serious pandemic.

However, since it doesn't prevent illness altogether, people would still need constant re-vaccination to avoid ordinary, seasonal flu. Two vaccine developers, the Israeli firm Biondavax and the American firm Dynavax are now testing vaccines they hope will prevent ordinary seasonal flu.

A vaccine that stops several kinds of seasonal flu is badly needed. The flu season getting under way this week in the US and Europe reveals a complex viral situation.

After previous flu pandemics, the viruses that were circulating beforehand have disappeared, replaced by the pandemic virus. But that has not happened this time.

Swine flu seems to have replaced one formerly common flu virus, from its own H1 family, and it dominated the Australian flu season. But the most deadly pre-pandemic virus, H3N1, remains common in China, south-east Asia and Africa, and has accounted for half the US cases tested this season.

This doesn't bode well for the elderly, who tend to resist swine flu but are vulnerable to H3. Meanwhile, H5N1 bird flu has struck 39 people so far this year, killing 20, most recently two Indonesians in September.

Journal reference: *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1013387107

<http://www.newscientist.com/article/dn19606-universal-flu-vaccine-one-step-closer.html>

### Gene therapy proposed to treat depression

- 20 October 2010
- Magazine issue 2783. **Subscribe and save**

A NOVEL treatment for depression may soon get the go ahead: injecting genes directly into the brain. It would be the first attempt to treat a psychiatric illness with gene therapy.

A gene called *p11* is vital for enabling neurons to respond to the neurotransmitter serotonin. A lack of *p11* has been shown to lead to depression in humans.

To test whether gene therapy could help, Michael Kaplitt of the Weill Cornell Medical College in New York City and colleagues first demonstrated that mice lacking *p11* showed symptoms of depression, failing to respond with the same vitality as healthy mice when exposed to challenges, such as showing decreased effort when having to swim to an island.

Next they injected viruses containing *p11* directly into the nucleus accumbens of the mice lacking *p11*. This part of the brain is where a lack of *p11* manifests itself as depression in humans. The team found this reversed the depression in the mice (*Science Translational Medicine*, DOI: [10.1126/scitranslmed.3001079](https://doi.org/10.1126/scitranslmed.3001079)).

Although the proposal to do the same in humans sounds drastic, Kaplitt points out that a similar procedure has already been used to deliver genes to the brain's of people with Parkinson's disease.

"We're already doing a primate study to support a potential human trial, so this is moving ahead very rapidly," says Kaplitt.

Injecting a virus containing the missing gene into a mouse's brain reversed its depression

<http://www.newscientist.com/article/mg20827831.900-gene-therapy-proposed-to-treat-depression.html>



### Prospective fathers should watch what they eat

- 20 October 2010
- Magazine issue 2783. **Subscribe and save**

WHAT fathers eat influences whether their daughters inherit diabetes - in mice at least.

While damaging effects of poor maternal diet have previously been shown, a new study suggests that prospective fathers need to keep an eye on their diet, too. It also provides a possible explanation for the diabetes epidemic sweeping industrialised countries.

Margaret Morris of the University of New South Wales in Sydney, Australia, and colleagues fed male rats a high-fat diet. They found that daughters sired by the obese rats developed diabetes before they reached puberty, with blood glucose concentrations double those of daughters born to lean males. The obese rats' daughters also produced half the amount of insulin, the hormone that regulates blood sugar levels, as those with lean fathers (*Nature*, DOI: [10.1038/nature09491](https://doi.org/10.1038/nature09491)).

"If similar effects apply in humans, it underlines the need for men to maintain a healthy diet and body weight, not only for their own health, but for that of the next generation," says Morris.

Analysis of the daughters' genetic material showed they had inherited DNA with abnormal "epigenetic" changes. The team suggests these were caused when the DNA in sperm was exposed to excessive dietary fat. The changes, produced through a process called methylation, were found to have altered the activity of 642 genes associated with the production of insulin by islet cells in the pancreas.

Unpublished experiments suggest that sons are affected in a similar way, says Morris.

<http://www.newscientist.com/article/mg20827833.700-prospective-fathers-should-watch-what-they-eat.html>



## Indian neutrino lab to boast world's biggest magnet

- 22:19 22 October 2010 by Anil Ananthaswamy

A major neutrino observatory set to be built in India cleared a major hurdle this week, when the Ministry of Environment and Forests formally approved the project.

The \$250 million underground laboratory, called the Indian Neutrino Observatory (INO), will be built in the Bodi West Hills Reserved Forest in the state of Tamil Nadu.

The hills there rise very steeply, so workers will have to tunnel only about 2 kilometres horizontally to provide the laboratory with about 1300 metres of high-quality granite cover above. The rock cover is needed to shield the neutrino detector from particles called muons that form when cosmic rays hit the atmosphere. INO will be made of 50,000 tonnes of magnetised iron, dwarfing the 12,500-tonne magnet in the Compact Muon Solenoid detector at CERN in Geneva, Switzerland. "It'll be the most massive magnet [ever built]," says team member M. V. N. Murthy of the Institute of Mathematical Sciences in Chennai, Tamil Nadu.

### Anti-neutrinos too

Neutrinos will interact with the iron – which will be layered in sheets – and spew out charged particles, whose paths will be bent by the iron's magnetic field. About 30,000 detectors sandwiched between the sheets of iron will track these charged particles, providing information about the incident neutrinos.

INO will initially study atmospheric neutrinos, which are produced when cosmic rays smash into the upper atmosphere.

Unlike most neutrino detectors, such as the Super-Kamiokande in Japan or the Sudbury Neutrino Observatory in Canada, INO will be sensitive to both neutrinos and anti-neutrinos, which interact with matter in different ways.

Neutrinos and their antimatter counterparts oscillate between three types: electron, tau and muon. INO should help physicists understand which of the three types is the lightest and which is the heaviest.

### Elephants and tigers

INO scientists hope the observatory will also be used to detect neutrinos beamed from specialised neutrino factories that might be built at CERN or Fermilab near Chicago, Illinois. "We are uniquely situated to look at those neutrinos," says Murthy.

Because the source of neutrinos from those sites would be highly controlled, physicists could study how neutrinos oscillate from one type to another as they pass through the Earth to INO.

This was not the first time the INO team has tried to get environmental clearance for its laboratory.

Previously, project leaders had selected a site in the Nilgiri Mountains in Tamil Nadu. The site already boasted an underground power station with 13 kilometres of tunnels, but the access road to reach it crossed an elephant corridor.

Even as physicists worked out how to minimise disruptions to wandering elephants, a wildlife sanctuary nearby was declared a tiger reserve in 2008. The observatory would have been perilously close to the reserve's 5-kilometre-wide buffer zone, so the project was denied clearance at that site.

<http://www.newscientist.com/article/dn19620-indian-neutrino-lab-to-boast-worlds-biggest-magnet.html>

## Galaxies get real when the dark side warms up

- 11:43 22 October 2010 by **Kate McAlpine**

"Cold, dark matter" has a certain ring to it, but new simulations of our corner of the cosmos suggest that dark matter – the stuff that is thought to underlie the universe – might be warm, with relatively fast-moving and lightweight particles.

In cosmology's standard model, dark matter is cold, made up of relatively heavy low-energy particles, and will happily settle into structures as small as planets. Hot dark matter has already been ruled out because its particles would move too fast for galaxies to form. But warm dark matter has smaller, faster particles that still allow for our familiar starry sky.

Most computer models produce a generic universe that doesn't resemble ours in detail, but Gustavo Yepes at the Autonomous University of Madrid, Spain, and his collaborators on the Constrained Local Universe Simulations (CLUES) project have tuned theirs to resemble the galaxies and clusters nearest Earth.

### **Boxed-in galaxies**

In their simulated universe, the CLUES team zoomed in on a small box of space – just 6.5 million light years to a side – which contains our local group of galaxies. Yepes and colleagues ran the simulation at high resolution, with about 60 million chunks of dark matter forming digital versions of the Milky Way, Andromeda and Triangulus galaxies.

The team simulated the development of our corner of the universe with both warm and cold dark matter, and compared the results with real data on satellite galaxies from the Arecibo radio telescope in Puerto Rico.

"The cold dark matter simulations predict that there should be 10 times more satellites than have been detected in our Milky Way and its neighbour, the Andromeda galaxy," says Yepes.

The warm dark matter models may do a better job of matching the observed number of these low-mass galaxies, says Mike Boylan-Kolchin of the Max Planck Institute in Garching, Germany, who did not take part in the research. But he also points out that there could be other explanations for the discrepancies between what the cold dark matter scenario implies and what we can actually see: it may be that we don't understand well enough how galaxies form, or we may not have detected some of these galaxies.

The formation of these satellite galaxies could perhaps be better modelled through "gastrophysics" – the astrophysics of space gases (see video above). In this version of the high-resolution simulation, another 60 million chunks are added to the mix. Their masses are just a fifth of those of their dark matter counterparts and they behave as gases.

Journal reference: *Astrophysical Journal*, DOI: [10.1088/0004-637x/700/2/1779](https://doi.org/10.1088/0004-637x/700/2/1779)

<http://www.newscientist.com/article/dn19613-galaxies-get-real-when-the-dark-side-warms-up.html>

## LCROSS mission may have struck silver on the moon

- 21:55 21 October 2010 by [Dana Mackenzie](#)
- For similar stories, visit the [Solar System](#) Topic Guide



Silver was found in small amounts in lunar rocks collected by the Apollo astronauts, and now its spectral signature may have been spotted by NASA's LCROSS mission (Image: T. A. Rector/I. P. Dell'Antonio/NOAO/AURA/NSF)

The title of the 1909 hit song *By the Light of the Silvery Moon* was not just poetic, it was also prophetic. A NASA spacecraft that crashed into the moon last year has found what appears to be silver, perhaps buried under a small layer of moon dust.

Last October, NASA crash-landed a rocket near the lunar south pole, lofting water in the resulting debris. Newly published studies of this mission, called LCROSS, reveal that about 5.6 per cent of the ejected material was water, and that similar concentrations of water may exist under the surface in a "permafrost" layer. Lead scientist [Anthony Colaprete](#) at NASA's Ames Research Center in California estimates that there could be a billion gallons of water within 10 kilometres of the probe's impact site.

Other chemicals were also detected in the impact plume by a spacecraft flying behind the impactor. "We're seeing a kitchen sink of other stuff that may be useful for human exploration," says Michael Wargo, NASA's chief lunar scientist.

One of the big surprises was two strong ultraviolet emission lines of silver. Because they appeared a few seconds after impact, Colaprete and his colleagues suspect that the silver might be in a layer of rock buried below the surface.



### Hopping around

To create the observed spectral lines, the silver would have to be much more concentrated than the 100 parts per billion measured in rocks returned by the Apollo astronauts. On Earth, silver is concentrated by geologic processes such as flowing water, but such processes do not operate on the moon.

So what might be concentrating the silver? One theory holds that volatile elements, such as mercury and magnesium, may hop along the moon's surface one atom at a time until they hit a "cold trap" – such as the permanently shadowed crater LCROSS smashed into – and stick.

Silver is not usually considered a volatile, but Robert Wegeng of the Pacific Northwest National Laboratory in Richland, Washington, who is not a member of the mission team, says it probably behaves like one in the vacuum and temperature conditions on the moon. Other useful metals, such as tellurium, indium, and selenium, may behave the same way, he says.

Paul Spudis of the Lunar and Planetary Institute in Houston, Texas, cautions that the spectral lines are not definitive. "We really need a surface rover mission," he says. "We can argue about emission spectra from now until doomsday, but I want an on-the-spot measurement before I'll finally believe it."

Journal reference: Science (vol 330, p 468)

<http://www.newscientist.com/article/dn19609-lcross-mission-may-have-struck-silver-on-the-moon.html>



### Kitchen sink experiment simulates exotic white holes

- 16:07 19 October 2010 by **David Shiga**
- Magazine issue 2783.



The ring-like ridge formed when a stream of fluid hits a flat surface behaves like a white hole event horizon (Image: Germain Rousseaux/U. Nice-Sophia Antipolis)

Expensive particle colliders are not the only way to explore far-out physics. It seems that water gushing from a tap and hitting a sink behaves like a white hole – the theoretical opposite of a black hole.

A black hole is a dense concentration of mass surrounded by an extremely powerful gravitational field. Nothing that falls within a certain radius surrounding it, known as the event horizon, escapes. A white hole is the opposite: its event horizon allows things to escape but prevents anything from entering. However, so far white holes only exist in theory, so cannot be studied observationally.

When water hits the bottom of a sink, it flows outwards in all directions. At a certain distance from the point where the water hits the sink, the outgoing liquid rapidly decelerates and piles up before continuing its outward flow, creating a ring-like ridge.

Physicists have previously suspected that any ripples that might arise beyond the ridge and travel towards it should not be able to get past the ridge. This is because at the ridge the water flows outwards at the maximum speed that ripples could travel inwards, so the ripples would make no forward progress, like a runner on a treadmill. This makes the ridge behave like a white hole event horizon.

Now this has been experimentally confirmed by Germain Rousseaux of the University of Nice in France and colleagues.

#### Opening angle

Instead of looking at water hitting a sink, the team examined what happens when a stream of viscous oil hits an empty aquarium. When they placed the tip of a needle in the path of the oil as it spread out from the collision point, it generated a v-shaped disturbance (see image).



The angle of the  $v$  depended on the relative speeds of the fluid and any ripples on its surface. When the team measured it, they found that the two speeds are indeed equal, preventing ripples flowing in and creating something akin to a white hole event horizon.

They also found that between the collision point and the ridge, the oil flowed faster than the ripple speed, causing any ripples arising there to be swiftly carried outwards – just as things inside a white hole should get spat out.

**'Try at home'**

"The experiment is based on a simple idea everyone can understand and try at home," says Ulf Leonhardt of the University of St Andrews, UK.

Daniele Faccio of Heriot-Watt University in Edinburgh, UK, who recently used lasers to simulate an event horizon, says studying black and white hole analogues could provide insights into the physics of these exotic objects. For example, in 1974, Stephen Hawking showed mathematically that event horizons should radiate light.

Our telescopes are not sensitive enough to confirm this, but analogue experiments like Rousseaux's could help reveal the physical mechanism for the radiation, which remains unclear.

Journal reference: [arxiv.org/abs/1010.1701](http://arxiv.org/abs/1010.1701)

<http://www.newscientist.com/article/dn19598-kitchen-sink-experiment-simulates-exotic-white-holes.html>

## Curious mathematical law is rife in nature

- 14 October 2010 by **Rachel Courtland**
- Magazine issue 2782.



Even pulsars follow Benford's law (Image: NASA)

WHAT do earthquakes, spinning stellar remnants, bright space objects and a host of other natural phenomena have in common? Some of their properties conform to a curious and little known mathematical law, which could now find new uses.

A subject of fascination to mathematicians, Benford's law states that for many sets of numbers, the first or "leading" digit of each number is not random. Instead, there is a 30.1 per cent chance that a number's leading digit is a 1. Progressively higher leading digits get increasingly unlikely, and a number has just a 4.6 per cent chance of beginning with a 9 ([see diagram](#)).

The law is named after physicist Frank Benford, who in 1938 showed that the trend appears in many number sets, from the surface area of rivers to baseball statistics to figures picked randomly from a newspaper. It later emerged that such distributions are "scale-invariant": if you convert the units of the numbers in the set, from metres to yards, say, the set will still conform to Benford's law.

Not all sets of numbers obey this law, but it crops up surprisingly often. As a result, mathematicians have put it to work, using deviations from it to detect cases of tax fraud, [voter fraud](#) and even digital image manipulation.

Now [Malcolm Sambridge](#) of the Australian National University in Canberra and colleagues have extended the list of natural phenomena with properties that follow Benford's law. Their new list includes the depths of almost 250,000 earthquakes that occurred worldwide between 1989 and 2009, the brightness of gamma rays that reach Earth as recorded by the Fermi space telescope, the rotation rates of spinning star remnants known as pulsars, and 987 infectious disease numbers reported to the World Health Organization in 2007 (*Geophysical Research Letters*, DOI: [10.1029/2010GL044830](#)).

It applies to quakes, the brightness of gamma rays reaching Earth and the rotations of dead stars

That Benford's law pops up in so many natural phenomena won't surprise mathematicians but may shock some scientists. When Sambridge's team presented Benford's law findings at a 2009 geoscience conference, one dubious attendee "thought we were having a laugh", he recalls.

Yet geoscience is ripe for new uses of the law, he says. As well as measuring earthquake depths, Sambridge's team also looked at the vertical displacements of the ground in Peru as the tsunami-triggering [Sumatra-Andaman earthquake of 2004](#) progressed. A set of ground shifts before the earthquake proper, when small movements were due to "background noise", did not follow Benford's law, but shifts that occurred during the quake itself did.



The team also examined seismic data recorded at the same time by a station in Canberra. The overall patterns in the shifts persisted but the exact extent of the adherence to the law varied differently over time than in the Peruvian measurements. The team then looked more closely at Canberra seismograms and found that they were consistent with a minor, local earthquake occurring at the same time, which could be the source of the discrepancy between the two measurements.

"That's the first time I know of where something physical like that was actually discovered using Benford's law," says Theodore Hill, a mathematician at the Georgia Institute of Technology in Atlanta, not involved with the work.

As well as using Benford's law to detect mild earthquakes, Sambridge says it could find other uses. "I'm hoping people will check it out in their data. It could signal something strange and something to investigate, perhaps something that you might not have spotted in another way." And checking if properties that adhere to Benford's law in nature also do so in computer simulations could be a way to check and improve misbehaving models.

Just how widespread the law is in nature is not known. When the team looked at the masses of 400 extrasolar planets, there was an anomalous bump in numbers starting with 6. This may be an artefact of a small sample, a problem with the measurement technique or a sign that exoplanet masses do not fit Benford's law.

<http://www.newscientist.com/article/mg20827824.700-curious-mathematical-law-is-rife-in-nature.html>

## Why complex life probably evolved only once

- 12:52 21 October 2010 by [Michael Le Page](#)
- 



Solving early life's energy crisis (Image: Donald Fawcett/Getty)

The universe may be teeming with simple cells like bacteria, but more complex life – including intelligent life – is probably very rare. That is the conclusion of a radical rethink of what it took for complex life to evolve here on Earth.

It suggests that complex alien life-forms could only evolve if an event that happened just once in Earth's history was repeated somewhere else.

All animals, plants and fungi evolved from one ancestor, the first ever complex, or "eukaryotic", cell. This common ancestor had itself evolved from simple bacteria, but it has long been a mystery why this seems to have happened only once: bacteria, after all, have been around for billions of years.

The answer, say [Nick Lane](#) of University College London and [Bill Martin](#) of the University of Dusseldorf in Germany, is that whenever simple cells start to become more complex, they run into problems generating enough energy.

The basic principles are universal. Even aliens need mitochondria

"It required a kind of industrial revolution in terms of energy production," says Lane. "[Our hypothesis] overturns the traditional view that the jump to complex eukaryotic cells simply required the right kinds of mutations."

"It is very, very convincing, in my opinion," says biologist [John Allen](#) of Queen Mary, University of London, on whose work Lane and Martin have drawn.

### Growing costs

To become more complex, cells need more genes and more proteins – and so they need to get bigger. As the volume of any object increases, however, its relative surface area falls: an elephant has less surface area per unit of volume than a mouse, for instance. This is a major problem because simple cells generate the energy they need using the membrane that encloses them.

Lane and Martin calculate that if a bacterium grew to the size of a complex cell, it would run out of juice. It might have space for lots of genes, but it would have barely enough energy to make proteins from them.

### Folds don't help

In theory, there is an easy answer to the energy problem: create lots of folds in the cell membrane to increase its surface area, which in turn will increase the amount of energy the membrane can produce. Indeed, many bacteria have such folds. But this leads to another problem as they get larger.

Producing energy by "burning" food is playing with fire. If the energy-producing machinery straddling the membrane is not constantly fine-tuned, it produces highly reactive molecules that can destroy cells. Yet fine-tuning a larger membrane is problematic because detecting and fixing problems takes longer.

These obstacles were overcome when a cell engulfed some bacteria and started using them as power generators – the first mitochondria.

By increasing the number of mitochondria, cells could increase their membrane area without creating maintenance problems: each mitochondrion is a self-contained system with built-in control and repair mechanisms.

### **Birth of complexity**

Once freed from energy restraints, genomes could expand dramatically and cells capable of complex functions – such as communicating with each other and having specialised jobs – could evolve. Complex life was born.

So if Lane and Martin are right, the textbook idea that complex cells evolved first and only later gained mitochondria is completely wrong: cells could not become complex until they acquired mitochondria.

Simple cells hardly ever engulf other cells, however – and therein lies the catch. Acquiring mitochondria, it seems, was a one-off event. This leads Lane and Martin to their most striking conclusion: simple cells on other planets might thrive for aeons without complex life ever arising. Or, as Lane puts it: "The underlying principles are universal. Even aliens need mitochondria."

Journal reference: *Nature*, vol 467, p 929

<http://www.newscientist.com/article/dn18734-why-complex-life-probably-evolved-only-once.html>

## The chaos theory of evolution

- 18 October 2010 by **Keith Bennett**
- Magazine issue 2782.



Evolution is chaotic (Image: Yehrin Tong)

*Forget finding the laws of evolution. The history of life is just one damn thing after another*

IN 1856, geologist Charles Lyell wrote to Charles Darwin with a question about fossils. Puzzled by types of mollusc that abruptly disappeared from the British fossil record, apparently in response to a glaciation, only to reappear 2 million years later completely unchanged, he asked of Darwin: "Be so good as to explain all this in your next letter." Darwin never did.

To this day Lyell's question has never received an adequate answer. I believe that is because there isn't one. Because of the way evolution works, it is impossible to predict how a given species will respond to environmental change.

That is not to say that evolution is random - far from it. But the neat concept of adaptation to the environment driven by natural selection, as envisaged by Darwin in *On the Origin of Species* and now a central feature of the theory of evolution, is too simplistic. Instead, evolution is chaotic.

Darwin's argument was two-fold: First, life evolves from common ancestors. Second, it evolves by means of natural selection and adaptation. The first part has been accepted as a basic premise of biology since 1859. The second is more controversial, but has come to be accepted over the past 150 years as the principal mechanism of evolution. This is what is known as "adaptationism".

Adaptationism certainly appears to hold true in microevolution - small-scale evolutionary change within species, such as changes in beak shape in Galapagos finches in response to available food sources.

However, there is still huge debate about the role of natural selection and adaptation in "macroevolution" - big evolutionary events such as changes in biodiversity over time, evolutionary radiations and, of course, the origin of species. Are these the cumulative outcome of the same processes that drive microevolution, or does macroevolution have its own distinct processes and patterns?

This is a long-running debate. In 1972, for example, Niles Eldredge and Stephen Jay Gould challenged the assumption that evolutionary change was continuous and gradual. Their "punctuated equilibrium" hypothesis argued that change happens in short bursts separated by long periods of stability, as distinct from the more continuous change over long periods expected to be the outcome of natural selection and adaptation.

Later, John Endler, an evolutionary biologist at the University of Exeter, UK, scrutinised claimed examples of natural selection but found a surprising lack of hard evidence (chronicled in his 1986 book *Natural Selection in the Wild*). More recently, and controversially, cognitive scientists Jerry Fodor of Rutgers University at New

Brunswick, New Jersey, and Massimo Piattelli-Palmarini of the University of Arizona in Tucson have pointed out philosophical problems with the adaptationist argument (*New Scientist*, 6 February, p 28).

Palaeoecologists like me are now bringing a new perspective to the problem. If macroevolution really is an extrapolation of natural selection and adaptation, we would expect to see environmental change driving evolutionary change. Major climatic events such as ice ages ought to leave their imprint on life as species adapt to the new conditions. Is that what actually happens?

Our understanding of global environmental change is vastly more detailed than it was in Lyell and Darwin's time. James Zachos at the University of California, Santa Cruz, and colleagues, have shown that the Earth has been on a long-term cooling trend for the past 65 million years (*Science*, vol 292, p 686). Superimposed upon this are oscillations in climate every 20,000, 40,000 and 100,000 years caused by wobbles in the Earth's orbit. Over the past 2 million years - the Quaternary period - these oscillations have increased in amplitude and global climate has lurched between periods of glaciation and warmer interglacials. The big question is, how did life respond to these climatic changes? In principle, three types of evolutionary response are possible: stasis, extinction, or evolutionary change. What do we actually see?

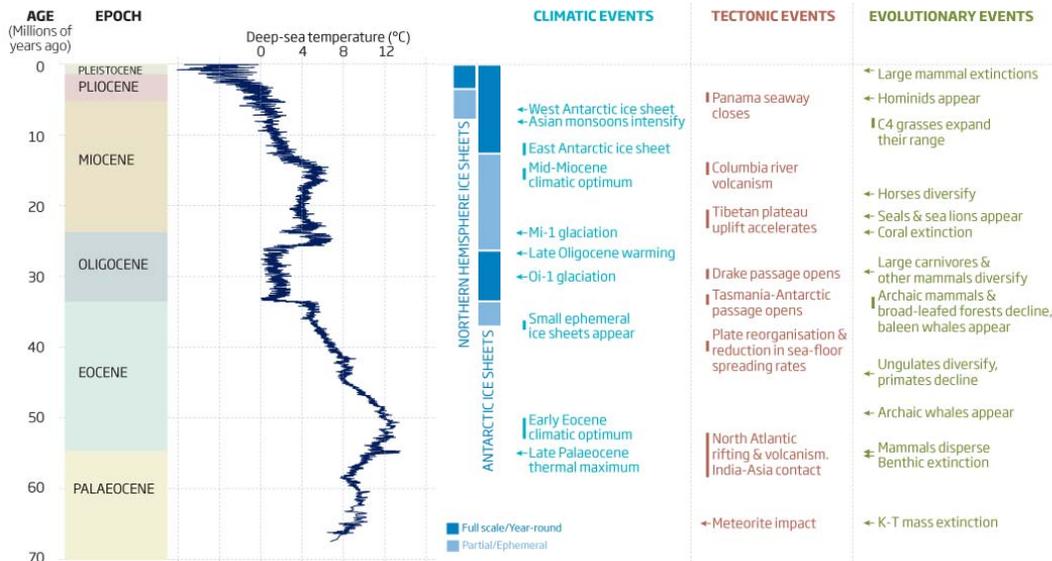
To answer that question we look to the fossil record. We now have good data covering the past 2 million years and excellent data on the past 20,000 years. We can also probe evolutionary history with the help of both modern and ancient DNA.

The highly detailed record of the past 20,000 years comes from analyses of fossilised tree pollen from lake and peat sediments. Tree pollen is generally recognisable to the level of genus, sometimes even species, and the sediments in which it is found can easily be radiocarbon dated.

In the 1970s and 1980s, palaeoecologist Margaret Davis at the University of Minnesota in Minneapolis created a map using this data which showed how North American tree taxa reached their respective present positions after the glaciers retreated at the end of the last ice age.

#### Roller-coaster Earth

The past 65 million years have seen major climatic and tectonic shifts, plus huge evolutionary changes, but connections between them are hard to discern



She found that the distribution shifts were individualistic, with huge variations between species in the rate, time and direction of spread. For example, larch spread from south-west to north-east, white pine from south-east to north-west. Rates vary from 100 metres a year to over 1000 metres (*Annals of the Missouri Botanical Garden*, vol 70, p 550). In other words, trees show no predictable response to climate change, and respond individually rather than as communities of species.

The fossil record also tells us that the make-up of modern forest communities differs from those of 20,000 years ago. Today we recognise various types of forest, such as boreal, deciduous and aspen parkland, each

with a distinctive mix of tree species. Yet the fossil record tells us that these are just temporary groupings. Multi-species communities do not have long histories and do not shift their distributions in a coordinated way in response to climate changes, as Darwin supposed. We therefore cannot assume that the members of modern forest communities evolved together or are somehow dependent on each other.

The same appears to be true over longer timescales. Pollen data show that during earlier interglacial periods, when the climate was most similar to now, forest compositions were very different from today.

Research on animals has come to similarly unexpected conclusions, albeit based on sparser fossil records. For example, palaeontologist Russell Graham at Illinois State Museum has looked at North American mammals and palaeontologist Russell Coope at the University of Birmingham in the UK has examined insects (*Annual Review of Ecology and Systematics*, vol 10, p 247). Both studies show that most species remain unchanged for hundreds of thousands of years, perhaps longer, and across several ice ages. Species undergo major changes in distribution and abundance, but show no evolution of morphological characteristics despite major environmental changes.

That is not to say that major evolutionary change such as speciation doesn't happen. But recent "molecular clock" research suggests the link between speciation and environmental change is weak at best.

### **Die hard**

Molecular clock approaches allow us to estimate when two closely related modern species split from a common ancestor by comparing their DNA. Most of this work has been carried out in birds, and shows that new species appear more or less continuously, regardless of the dramatic climatic oscillations of the Quaternary or the longer term cooling that preceded it (*Trends in Ecology and Evolution*, vol 20, p 57).

What of extinction? Of course, species have gone extinct during the past 20,000 years. However, almost all examples involve some degree of human activity, either directly (think dodos) or indirectly (large mammals at the end of the last ice age, 12,000 years ago).

In fact, we only know of one recent extinction with no human involvement - a species of spruce, *Picea critchfieldii*, which was common in the lower Mississippi valley at the height of the last ice age but died out 12,000 years ago (*Proceedings of the National Academy of Sciences*, vol 96, p 13847). Others undoubtedly occurred, but extinction appears to be a surprisingly rare response to substantial climatic changes (see diagram).

The overall picture is that the main response to major environmental changes is individualistic movement and changes in abundance, rather than extinction or speciation. In other words, the connection between environmental change and evolutionary change is weak, which is not what might have been expected from Darwin's hypothesis.

The link between environmental change and evolutionary change is weak - not what Darwinists might have predicted

If environmental changes as substantial as continent-wide glaciations do not force evolutionary change, then what does? It is hard to see how adaptation by natural selection during lesser changes might then accumulate and lead to macroevolution.

I suggest that the true source of macroevolutionary change lies in the non-linear, or chaotic, dynamics of the relationship between genotype and phenotype - the actual organism and all its traits. The relationship is non-linear because phenotype, or set of observable characteristics, is determined by a complex interplay between an organism's genes - tens of thousands of them, all influencing one another's behaviour - and its environment.

Not only is the relationship non-linear, it also changes all the time. Mutations occur continually, without external influence, and can be passed on to the next generation. A change of a single base of an organism's DNA might have no consequence, because that section of DNA still codes for the same amino acid.

Alternatively, it might cause a significant change in the offspring's physiology or morphology, or it might even be fatal. In other words, a single small change can have far-reaching and unpredictable effects - the hallmark of a non-linear system.

Iterating these unpredictable changes over hundreds or thousands of generations will inevitably lead to evolutionary changes in addition to any that come about by the preferential survival of certain phenotypes. It

follows that macroevolution may, over the longer-term, be driven largely by internally generated genetic change, not adaptation to a changing environment.

The evolution of life has many characteristics that are typical of non-linear systems. First, it is deterministic: changes in one part of the system, such as the mutation of a DNA base, directly cause other changes.

However, the change is unpredictable. Just like the weather, changes are inexorable but can only be followed with the benefit of hindsight.

Second, behaviour of the system is sensitive to initial conditions. We see this in responses to glaciations in the Quaternary period. The exact circumstances of the beginning of each interglacial determine the development of the whole period, leading to unpredictable differences between interglacials (*Quaternary Science Reviews*, vol 14, p 967).

Third, the history of life is fractal. Take away the labelling from any portion of the tree of life and we cannot tell at which scale we are looking (see diagram). This self-similarity also indicates that evolutionary change is a process of continual splitting of the branches of the tree.

Fourth, we cannot rewind, as Stephen Jay Gould argued in *Wonderful Life*. Were we to turn the evolutionary clock back to any point in the past, and let it run again, the outcome would be different. As in weather systems, the initial conditions can never be specified to sufficient precision to prevent divergence of subsequent trajectories.

Life on Earth is always unique, changing, and unpredictable. Even if certain patterns can be dimly discerned, our ability to do so diminishes with time, exactly as for the weather. Consider any moment of the geological record of life on Earth: to what extent were the changes of the next 10 or 100 million years predictable at that time? With the benefit of hindsight, we might be able to understand what happened, and construct a plausible narrative for those events, but we have no foresight.

This view of life leads to certain consequences. Macroevolution is not the simple accumulation of microevolutionary changes but has its own processes and patterns. There can be no "laws" of evolution. We may be able to reconstruct the sequence of events leading to the evolution of any given species or group after the fact, but we will not be able to generalise from these to other sequences of events. From a practical point of view, this means we will be unable to predict how species will respond to projected climate changes over next century.

The question Lyell put to Darwin over 150 years ago is unanswerable because Lyell put it in terms of a particular group of organisms. Not even Darwin would be able to explain why that specific group behaved as it did.

In the last analysis, evolution can be likened to the description of human history as "just one damn thing after another", exactly as Fodor and Piattelli-Palmarini have argued.

We still have much to learn about how life evolved but we will not develop a full appreciation until we accept the complexity of the system.

*Keith Bennett is professor of late-Quaternary environmental change at Queen's University Belfast, guest professor in palaeobiology at Uppsala University in Sweden, and author of Evolution and Ecology: The Pace of Life (Cambridge University Press). He holds a Royal Society Wolfson Research Merit Award*

<http://www.newscientist.com/article/mg20827821.000-the-chaos-theory-of-evolution.html?full=true&print=true>

### Should schoolchildren be typecast into science?

- 22 October 2010 by **Jo Marchant**
- Magazine issue 2783.

SCIENCE suits shy people. A Dutch study has found that introverted students are more likely to choose science subjects at school, while more sociable peers tend to drop them at the first opportunity - regardless of their natural ability. The study raises the question: should teachers encourage students to choose subjects that "fit" their personality or to break out of the mould?

Education researcher Hanke Korpershoek and her colleagues at the University of Groningen used data from a study which followed thousands of Dutch students throughout their education and included personality tests. Korpershoek analysed data from nearly 4000 students and found that their subject choices at age 15 were affected by personality. Students who chose science subjects tended to be less extroverted than those who chose non-science subjects. They also scored more highly on conscientiousness and emotional stability (*Journal of Research in Personality*, vol 44, p 649).

The result remained significant even after controlling for the effects of mathematical ability and gender. This is the first study to investigate how personality differences affect students' subject choices, according to Korpershoek.

"There's a feeling that science students have nerdy characteristics," she says, "but we were surprised to see it in our results, and to see it as early as age 15."

She reckons schools could do more to help students to choose subjects that match their personalities. While she says it would be premature to guide students based on personality tests, she argues that teachers should focus not just on a subject's content but on the type of job it would lead to. For example if someone's talent is being tidy, orderly and precise, then they might enjoy working in a lab.

Michael Reiss, professor of science education at the Institute of Education in London, counters that science teachers should try to attract a broader range of students. "It would be a disaster if the advice 'you should only do physics if you are introverted' was given in schools," he says. "We want all students, whatever their personality, to find things within science that intrigue and excite them."

It would be a disaster if you were told you should only do physics if you are introverted

<http://www.newscientist.com/article/mg20827833.100-should-schoolchildren-be-typecast-into-science.html>



### Synthetic DNA makers warned of bioterrorism threats

- 22 October 2010
- Magazine issue 2783

TO MAKE it harder for bioterrorists to build dangerous viruses from scratch, guidelines for firms who supply "custom DNA" are being introduced in the US.

The US and other countries restrict who can work with certain germs, but it might be possible to build some viruses from their genes. A number of firms supply DNA sequences to order. A 2005 investigation by *New Scientist* raised alarms when it found that only five out of 12 of these firms in North America and Europe always screened orders for sequences that might be used in bioweapons.

The US now wants firms to verify a customer's identity and make sure they are not on a list of banned buyers. It also wants them to screen orders for sequences that are unique to Select Agents, a list of microbes the US deems dangerous.

However, scientists commenting on the draft rules earlier this year fear that sequences from microbes other than Select Agents might also be dangerous. The US Department of Health says not enough is known about them to say which ones should arouse a firm's suspicions. Other potential weaknesses include the fact that the rules are voluntary, and that much custom DNA is made outside the US.

<http://www.newscientist.com/article/mg20827832.200-synthetic-dna-makers-warned-of-bioterrorism-threats.html>

### Creationism lives on in US public schools

- 20 October 2010 by **John Farrell**
- Magazine issue 2783.



In Dover, Pennsylvania, creationists were voted out – but not elsewhere (Image: Carolyn Kaster/AP/PA) IN DOVER, Pennsylvania, five years ago, a group of parents were nearing the end of an epic legal battle: they were taking their school board to court to stop them teaching "intelligent design" to their children. The plaintiffs eventually won their case, and on 16 October many of them came together for a private reunion. Yet intelligent design and the creationism for which it is a front are far from dead in the US, and the threat to the teaching of evolution remains.

Cyndi Sneath was one of the Dover plaintiffs who had a school-age son at the time of the trial. She has since become an active member of the American Civil Liberties Union and a member of the Dover Area School Board. "My interest in public education and civil liberties was certainly sparked by the trial," she says. "And that interest permeates our family discussions."

Chemistry teacher Robert Eschbach, who was also a plaintiff, says the trial has made teachers less afraid to step on people's toes when it comes to evolution. It "forced me to be a better educator", he says. "I went back and read more of the history around Darwin and how he came to his conclusions."

None of this means that the Discovery Institute, the Seattle-based think tank that promotes intelligent design, has been idle. The institute helped the conservative Louisiana Family Forum (LFF), headed by Christian minister Gene Mills, to pass a state education act in 2008 that allows local boards to teach intelligent design alongside evolution under the guise of "academic freedom".

Philosopher Barbara Forrest of Southeastern Louisiana University, another key witness for the Dover plaintiffs in 2005, testified against the Louisiana education act. "Louisiana is the only state to pass a state



education bill based on the Discovery Institute's template," she says. Similar measures considered in 10 other states were all defeated.

Forrest heads the Louisiana Coalition for Science, and has been monitoring developments since the bill passed. In January 2009, the Louisiana Board of Elementary and Secondary Education (BESE) approved a policy that prevents Louisiana school boards from stopping schools using supplementary creationist texts hostile to evolution, such as books published by the Discovery Institute.

Mills has now made public his desire to change the process for selecting biology textbooks statewide. In one Louisiana township, Livingston Parish, creationist board members have proclaimed their desire to have creationism taught alongside evolution in the next academic year. "This is happening with no outcry from the media or from the scientific community in Louisiana," Forrest says.

Since Dover, states wanting to teach alternatives to established science have used deliberately vague language. In 2008, Louisiana passed a law requiring "open and objective discussion" of climate change, evolution and human cloning. Five years after the landmark case, the battle for science education continues. But for the plaintiffs and their representatives this does not detract from the achievement. Their lead attorney, Eric Rothschild, sums it up: "If we'd lost, intelligent design would be all over the place now".

<http://www.newscientist.com/article/mg20827833.000-creationism-lives-on-in-us-public-schools.html>



## With this printer, what you see is what you smell

- 22 October 2010 by **Paul Marks**
- Magazine issue 2783.

Smells like the real thing (Image: Dex Image/Getty)



THAT crisp apple colour and that crisp apple smell could one day come out of the same ink-jet printer, if an idea hatched in a Japanese lab takes off. Using technology from existing ink-jet printers, the idea is to generate evocative aromas to complement images on your computer or TV, from the scent of a mown lawn in a family photo to truffles in a cookery show.

Scent-assisted movies were tried out in the mid-20th century. AromaRama pumped scent into cinema air conditioning, while the rival Smell-O-Vision had its own dedicated system of pipes. Both were abject failures, with noisy machinery or patchy odours. Worst of all, each aroma lingered too long and mixed with the next, blending into a noxious stench by the closing credits. More recent attempts to make whiffy peripherals, such as the iSmell USB device from Digiscents in 2000, fell at the same hurdle.

But ink-jet printing technology can do the job, according to Kenichi Okada of Keio University in Tokyo and colleagues, who will present their work at the Association for Computing Machinery's Multimedia conference in Florence, Italy, next week. "We are using the ink-jet printer's ability to eject tiny pulses of material to achieve precise control," Okada told *New Scientist*.

In the most common type of ink-jet, a pulse of current heats a coil of wire, creating bubbles that force a small volume of ink down a tube and onto the page at high speed. The Keio team use the same hardware to squirt scent. Working with printer maker Canon, they converted the guts of an off-the-shelf printer into what they call an olfactory display, capable of rapidly switching between four aromas.

They found that a standard Canon ink-jet can eject as little as a picolitre of scent droplets in 0.7 milliseconds. That is too little to smell, but pulses 100 milliseconds long produced perceivable aromas of lemon, vanilla, lavender, apple, cinnamon, grapefruit and mint. Better still, a 100-millisecond ink-jet burst dissipates fast, at least in the team's small-scale experiment. After an average of two human breaths it has gone, allowing a different smell to be activated.

The next step is to work out how to automatically sync scents with pictures, says Okada. If it works, a single ink-jet machine might serve as both printer and odour projector.

Such technology might have applications beyond entertainment, according to Stephen Brewster at the University of Glasgow, UK, who studies human-computer interaction. His group is researching ways to give people with dementia unobtrusive reminders that they need to take pills, for example, or need to eat. "A strong smell of food might do that but our technology is very basic - blowing a fan over smell-infused felt. We need a better way, and this might be it," he says.

But building a general-purpose aroma creator won't be easy, says Brewster. "We don't yet know how to synthesise all the scents we want. There is no red-green-blue for smell - there are thousands of components needed. You can't synthesise raspberry from chocolate."

There is no red-green-blue for smell. You can't synthesise raspberry from chocolate

<http://www.newscientist.com/article/mg20827834.500-with-this-printer-what-you-see-is-what-you-smell.html?full=true&print=true>

### **This incompetent robot will self-destruct**

- 17:13 19 October 2010 by **Sandrine Ceurstemont**
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Robots are usually designed to be useful, but an amateur robotics competition last weekend indulged in technology gone wrong.

Organised by SparkFun Electronics in Boulder, Colorado, the Antimov competition mischievously subverts Isaac Asimov's Three Laws of Robotics, one of which states that a robot must protect its own existence. Instead, the competition challenged people to build a robot that attempts a simple, menial task but fumbles it or fails, before destroying itself. Participants could either submit their entries as a video, or present their creation live, at an event on 16 October.

#### **Spectacular failures**

The winning video (see above) features a teddy bear birthday party, where a robot tries to cut a cake, but instead emits a spark that sets fire to itself and its fellow diners – a toy bear and a clown. In another, a robot called Chefbot fails spectacularly to make a crème brûlée, by misdirecting its cooking blowtorch.

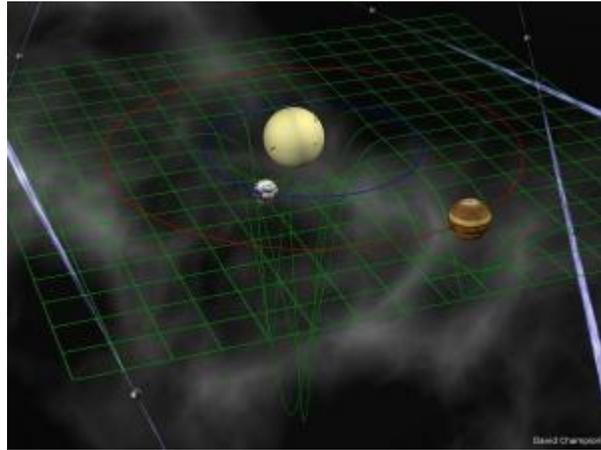
According to Peter Dokter, one of the organisers, the live entries were just as self-destructive, but because of fire regulations most of them involved mechanical deaths. "One of the participants perched a robot on top of a clothes dryer. It knocked cans of Pringles chips into it, inadvertently fell in, then got completely wrecked by the machine," he says.

#### **Spark of genius**

SparkFun hopes to run the competition again next year with more participants. "The design doesn't need to be complicated, you just need to create something that shows a bit of cleverness," says Dokter. "There are lots of creative ways to destroy something."

<http://www.newscientist.com/article/dn19599-this-incompetent-robot-will-selfdestruct.html?full=true&print=true>

## A New Way to Weigh Planets



*The Sun, Earth and Jupiter orbit a common barycentre. (Credit: D. Champion, MPIfR)*

ScienceDaily (Oct. 23, 2010) — An international CSIRO-led team of astronomers has developed a new way to weigh the planets in our Solar System -- using radio signals from the small spinning stars called pulsars.

"This is first time anyone has weighed entire planetary systems -- planets with their moons and rings," said team leader Dr David Champion from Germany's Max-Planck-Institut für Radioastronomie.

"And we've provided an independent check on previous results, which is great for planetary science."

Measurements of planet masses made this new way could feed into data needed for future space missions.

Until now, astronomers have weighed planets by measuring the orbits of their moons or of spacecraft flying past them. That's because mass creates gravity, and a planet's gravitational pull determines the orbit of anything that goes around it -- both the size of the orbit and how long it takes to complete.

The new method is based on corrections astronomers make to signals from pulsars -- small spinning stars that deliver regular 'blips' of radio waves.

The Earth is travelling around the Sun, and this movement affects exactly when pulsar signals arrive here.

"This is first time anyone has weighed entire planetary systems -- planets with their moons and rings," says Dr David Champion from Germany's Max-Planck-Institut für Radioastronomie.

To remove this effect, astronomers calculate when the pulses would have arrived at the Solar System's centre of mass, or barycentre, around which all the planets orbit.

Because the arrangement of the planets around the Sun changes all the time, the barycentre moves around too.

To work out its position, astronomers use both a table (called an ephemeris) of where all the planets are at a given time, and the values for their masses that have already been measured.

CSIRO Astronomy and Space Science (CASS) researcher, Dr Dick Manchester, says that if these figures are slightly wrong, and the position of the barycentre is slightly wrong, then a regular, repeating pattern of timing errors appears in the pulsar data.

"For instance, if the mass of Jupiter and its moons is wrong, we see a pattern of timing errors that repeats over 12 years, the time Jupiter takes to orbit the Sun," Dr Manchester said.

"But if the mass of Jupiter and its moons is corrected, the timing errors disappear. This is the feedback process that the astronomers have used to determine the planets' masses."

Data from a set of four pulsars have been used to weigh Mercury, Venus, Mars, Jupiter and Saturn with their moons and rings. Most of these data were recorded by CSIRO's Parkes radio telescope in eastern Australia, with some contributed by the Arecibo telescope in Puerto Rico and the Effelsberg telescope in Germany.

The masses were consistent with those measured by spacecraft. The mass of the Jovian system,  $9.547921(2) \times 10^{-4}$  times the mass of the Sun, is significantly more accurate than the mass determined from the Pioneer and Voyager spacecraft, and consistent with, but less accurate than, the value from the Galileo spacecraft.

The new measurement technique is sensitive to a mass difference of two hundred thousand million million tonnes -- just 0.003 per cent of the mass of the Earth, and one ten-millionth of Jupiter's mass.

CASS scientist Dr George Hobbs says that, in the short term, spacecraft will continue to make the most accurate measurements for individual planets.

"But the pulsar technique will be the best for planets not being visited by spacecraft, and for measuring the combined masses of planets and their moons," Dr Hobbs said,

Repeating the measurements would improve the values even more. If astronomers observed a set of 20 pulsars over seven years they'd weigh Jupiter more accurately than spacecraft have. Doing the same for Saturn would take 13 years.

The head of the 'Fundamental Physics in Radio Astronomy' research group at the Max-Planck-Institut für Radioastronomie, Professor Michael Kramer, says astronomers need this accurate timing because they are using pulsars to hunt for gravitational waves predicted by Einstein's general theory of relativity.

"Finding these waves depends on spotting minute changes in the timing of pulsar signals, and so all other sources of timing error must be accounted for, including the traces of Solar System planets," Professor Kramer said.

The above story is reprinted (with editorial adaptations by *ScienceDaily* staff) from materials provided by **CSIRO Australia**.

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