Infoteca's E-Journal

An Electronic Compilation of Scientific and Cultural Information by
Sistema de Infotecas Centrales, Universidad Autónoma de Coahuila

UA de C. Universidad comprometida

CONTENTS

9th Annual Year in Ideas	3
Can't find the words? Google with a photo instead	50
Early birds may have dropped teeth to get airborne	52
Innovation: Making a map for everyone, by everyone	53
Stephen Wolfram: 'I'm an information pack rat'	55
Psychiatry's civil war	58
The perfect way to slice a pizza	63
Stem cells 'to fix cloudy cornea'	66
Child cancer heart checks urged	68
Battery made of paper charges up	70
Measures target child web safety	72
Hubble sees most distant galaxies	75
Firm Body, No Workout Required?	78
Earth More Sensitive to Carbon Dioxide Than Previously Thought	80
Better Way for Computers to 'See' Combines Molecular Biology and Gaming Hardware	82
Single-Atom Transistor Discovered	84
Microorganism May Provide Key to Combating Giant Salvinia Throughout Louisiana	86
Dessert on Your Mind? Your Muscles May Be Getting the Message	88
Balancing Protein Intake, Not Cutting Calories, May Be Key to Long Life	90
Nervy Research: Researchers Take Initial Look at Ion Channels in a Model System	92
Key Seed Size Gene Identified	94
For African Violets, 'Hands Off' Means Healthier	96
Superbright Supernova Is First of Its Kind	98
Marine Life Collected to Inventory DNA Sequence of All Pacific Island's Living Species	101
'Killer Petunias' Should Join the Ranks of Carnivorous Plants, Scientists Propose	103
Popular Herbicide Affects Sexual Development in Frogs, Research Finds	105
Combining Nanotubes and Antibodies for Breast Cancer 'Search and Destroy' Missions	106
Social Scientists Build Case for 'Survival of the Kindest'	108
How Dinoflagellates Protect Themselves During Photosynthesis	111
Logging Effects Vary Based on a Forest's History, Climate	113
Brightness Variations of Sun-Like Stars: The Mystery Deepens	115
Deep Space Maintenance Deep in Australia's Bush	117
Milling and Drilling in Cyberspace	119
Maize Was Passed from Group to Group of Southwestern Hunter-Gatherers	121
Parasite Evades Death by Promoting Host Cell Survival	123
Life on Mars Theory Boosted by New Methane Study	125

Tiny RNA Has Big Impact on Lung Cancer Tumors 127
Introns Nonsense DNA May Be More Important to Evolution of Genomes 128
Can Biodiversity Persist In The Face Of Climate Change? 131
Scientists Crack Mystery of Protein's Dual Function 133
Nanosensors Used to Measure Cancer Biomarkers in Blood for First Time 135
Innovative Plan To Save Rainforest, Reduce Greenhouse Gas Emissions 137
New Understanding of How to Prevent Destruction of a Tumor Suppressor 140
Health Effects of Low-Intensity Warfare Studied 142
Syntax in Our Primate Cousins 144
How Can Some Athletes Play on Through Intense Pain? 146
Bacteria Provide New Insights Into Human Decision Making 148
Understanding Ocean Climate 151
Absorbing Hydrogen Fluoride Gas to Enhance Crystal Growth 153
Caffeine Doesn't Reverse the Negative Cognitive Impact of Alcohol, Study Shows 155
Model of Skin Cancer Provides Insights on Second-Most Common Type of Cancer 157
Brightest-Ever 'Blazar' Flare from Distant Galaxy Spotted by NASA's Space Telescope 159
Older Dental Fillings Contain Form of Mercury Unlikely to Be Toxic, Study Finds 160
West Nile Virus Infection May Persist in Kidneys Years After Initial Infection 161
Lightning-Produced Radiation a Potential Health Concern for Air Travelers 163
Suzaku Catches Retreat of a Black Hole's Disk 165
Fast, Accurate Urine Test for Pneumonia Possible, Study Finds 167
Women Researchers Less Likely to Receive Major Career Funding Grants 169
UK warns on 'acidifying oceans' 171
Genetic 'map' of Asia's diversity 173
Volume turned down on MP3 players 175
Autism limit on 'self-awareness' 178
Body clock link to heart disease 180
Exercise 'no aid' for period pain 182
20mph zones 'cut injuries by 40%' 184
Alcohol post-breast cancer risk 186
Ancient Med flood mystery solved 188
New drug threat to Asian vultures 190
Major child cancer trial launched 192
'Six-hour window' to erase fear 194
You have the power to make music... evolve 196
Brain scan reveals who will keep their promises 198
Our atmosphere came from outer space 200

THE 9TH ANNUAL YEAR IN IDEAS

Once again, The Times Magazine looks back on the past year from our favored perch: ideas. Like a magpie building its nest, we have hunted eclectically, though not without discrimination, for noteworthy notions of 2009 — the twigs and sticks and shiny paper scraps of human ingenuity, which, when collected and woven together, form a sort of cognitive shelter, in which the curious mind can incubate, hatch and feather. Unlike birds, we can also alphabetize. And so we hereby present, from A to Z, the most clever, important, silly and just plain weird innovations we carried back from all corners of the thinking world. To offer a nonalphabetical option for navigating the entries, this year we have attached tags to each item indicating subject matter. We hope you enjoy.

Advertisement That Watches You, The

ADVERTISEMENT PHOTOGRAPHY BY JUNG VON MATT

"It happens when nobody is watching." As the tagline on a poster raising awareness about domestic violence, that's not bad. But it was the poster itself that was truly attention-grabbing — for it brought the issue of being watched (or not) to life.

The poster, placed in a bus shelter in Berlin, was a one-time installation sponsored by Amnesty International. When a person in the shelter was looking at the poster, he saw, along with the words, a photograph of an amiable couple: a stocky, professional-looking man in a blue oxford-cloth shirt, his arm around the shoulders of his girlfriend or wife. If no one in the shelter was paying attention to the poster, though, the image switched: now the man was raising his fist against the woman as she leaned away and protected her face. (There was a slight lag in the switch, so viewers could notice that the poster was changing its image.)Designed by the Hamburg-based firm Jung von Matt (which bills itself as being in the business of "attention warfare"), the ad worked via a camera attached to a

Using a camera and face-tracking software, a poster in a Berlin bus shelter demonstrates what may be happening only when nobody is looking.computer outfitted with face-tracking software with a working range of about 16 feet. A Potsdam company called Vis-à-pix created the technology. Jung von Matt described the ad as the first of its kind, and it won a silver prize at the 2009 Cannes Lions International Advertising Festival and a gold prize at the New York Festivals International Advertising Awards.

The technology has since improved, according to Vis-à-pix. New posters can even identify the sex of onlookers. Consider a poster created for the service counters of the rental-car company Sixt: when a man gets close, he is tempted with an image of a limousine; if the customer is a woman, she sees, instead, a spunky Cabriolet. CHRISTOPHER SHEA

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#a

Artificial Car Noise

ILLUSTRATION BY MARC JOHNS

Nothing seemed to herald the end of the internal combustion engine more than the ability of hybrid cars to leap suddenly to life without the slightest sound. Unfortunately, it turns out that the sweet silence of 21st-century technology has a serious downside: pedestrians and bicyclists are less likely to hear hybrids and electric cars coming their way and are more likely to be clipped or run over. That has prompted a back-to-the-future solution: fake car noise that will alert the unwary.

The evidence that hybrids might be hard to hear coming has been accumulating for years, though it wasn't until the

National Highway Traffic Safety Administration recently released a study that the full extent of the problem was revealed. Data derived from thousands of accidents revealed that there was no difference between hybrids and conventional vehicles on straightaways. But at intersections, interchanges, parking lots and other places where cars traveled at slow speeds, hybrids proved far more hazardous, with pedestrians and bicyclists getting hit at up to twice the normal rate.

Animation by Peepshow Collective

Having spent years trying to make cars quieter, manufacturers of hybrids and electric cars now find themselves in the curious position of figuring out the best means of warning people that 3,000 pounds of metal is rolling their way. A melodious trill? The muted roar of a muscle car? A hook from some annoying song? So far there's no consensus, and absent any standard there's a risk that the roads of tomorrow will play host to a cacophony of hoots, whistles and whirs.

As the debate continues, manufacturers of hybrid and electric cars, like Nissan and Fisker, are rolling out models equipped with high-tech noises that broadcast both their car's presence and their futuristic status. Others, like the high-end manufacturer Tesla, are holding out and sticking with the sound of silence.
STEPHEN MIHM

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#a

Bicycle Highways

PHOTO ILLUSTRATION BY REINHARD HUNGER
SET DESIGN BY SARAH ILLENBERGER

The bicycle highway — no red lights, no cars — is every cyclist's fantasy. There are now signs that infrastructure is catching up with the dream. In October 2008, an association of U.S. state-highway officials approved the concept of a national Bicycle Routes Corridor Plan — the first step in potential American bike Interstates. But this amounts to little more than a go-ahead for states to put bike-route signs on existing roads.

Copenhagen, however, began last month to create the real thing: a system of as many as 15 extra-wide, segregated bike routes connecting the suburbs to the center of the city. These are not bucolic touring paths; Copenhagen's bike highways are meant to move traffic. Nearly 40 percent of Copenhagen rides a bike to work. On Norrebrogade, a two-mile street in the center of the city, 36,000 cyclists clog the bike lane every day. The Bicycle Office of Copenhagen's design calls for service stations (with air pumps and tools for simple repairs) and plans to employ so-called intelligent transportation systems — not unlike the technology that makes the E-ZPass possible. Using handlebar-mounted RFID or GPS technology, for example, commuters could detect other riders on the routes, helping them to assemble into pelotons or "bike buses." These groups could in turn emit signals that trip traffic lights in their favor, resulting in a "green wave" of bicycle momentum.

But Jan Gehl, the Danish architect and infrastructure consultant, warns that as appealing as the bike highway seems, it is not the first step in creating a bicycle culture. The bicycle highway is needed, he stresses, only after a city is comfortable for bike riders, as Copenhagen is. He considers the hundreds of kilometers of protected bike lanes in central Copenhagen to be a kind of bicycle oasis. "Some cities will go for the bicycle highways and let people fend for themselves once they reach the city," he says. "You get off the highway, and then you're in the desert. In Copenhagen we have first irrigated the desert, then built the highways." WM. FERGUSON

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#b

Black Quarterbacks Are Underpaid

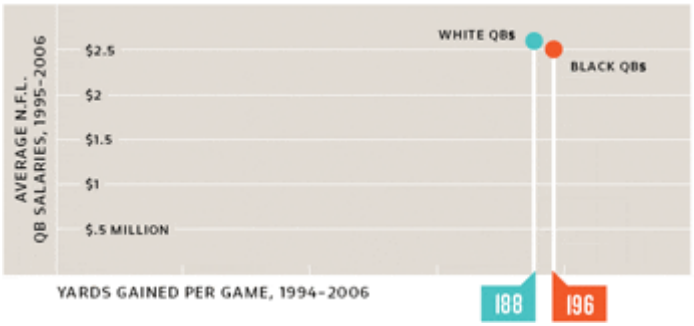


Chart by LamoscaWhite

When Rush Limbaugh tried and failed to join the clubby ranks of National Football League owners this year, his past comments came back to haunt him, none more so than his assessment of the Philadelphia Eagles star Donovan McNabb — namely that the news media overrated McNabb because he is black and that he was simply not "that good of a quarterback." But according to the economists David J. Berri and Rob Simmons, Limbaugh might have been giving public voice to what the owners who spurned him think privately.

In an article for the February issue of Journal of Sports Economics, Berri and Simmons found that black quarterbacks tend to be paid less than their white counterparts and that the pay disparity is especially pronounced for top-flight black quarterbacks, who don't make as much money as the best white quarterbacks.

Given the N.F.L.'s sorry history when it comes to black quarterbacks — it wasn't until the mid-1990s that many black athletes even began playing the position — it's possible that the pay disparity is attributable to simple racism. But Berri and Simmons offer a more subtle explanation: statistical bias.

quarterbacks earned more on average, but black quarterbacks outperformed them in a key category over a similar period.

The key is that owners do not fairly compensate quarterbacks who are good at running the ball in addition to throwing it. Using 35 years of data, Berri and Simmons found that while white quarterbacks, on average, run with the ball on only 6.7 percent of their plays, gaining a measly 7.3 yards per game, black quarterbacks run, on average, 11.3 percent of the time and gain 19.4 rushing yards per contest. In other words, many black quarterbacks tend to be good runners as well as good passers. And quarterbacks are not paid for the rushing yards they produce.

Perhaps that's because the quarterback rating — the N.F.L.'s gold standard for evaluating quarterbacks statistically — does not include rushing yards as one of its four components. The formula considers only completions, passing yards, touchdowns and interceptions. Thus "a key offering" of many black quarterbacks, write Berri and Simmons, "is ignored." JASON ZENGERLE

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#b

Cognitive Illiberalism

JUSTICE JOHN PAUL STEVENSILLUSTRATION BY CATH RILEY

Could the Supreme Court be undermining its legitimacy through its ignorance of some basic tenets of social psychology? Three law professors — Dan M. Kahan of Yale, David A. Hoffman of Temple and Donald Braman of George Washington — made that case in an article published in January in The Harvard Law Review. They charged the justices with the sin of "cognitive illiberalism."The article centered on a 2007 case, Scott v. Harris. Victor Harris was rendered quadriplegic after the police rammed his car, ending a nine-mile high-speed chase outside Atlanta. The issue was whether a suit by Harris against the officer who rammed him should be allowed to proceed to a jury trial. Lower courts were inclined to give Harris his day in court, because he had committed no crime except speeding before he fled, and while he topped 85 miles per hour during the chase, he was in theory in control of his car.

The Supreme Court disagreed and defended its position in an unprecedented way: by posting a video of the chase, taken by the police, on its Web site. "No reasonable jury," Antonin Scalia wrote for the majority, could watch the video without agreeing that the chase had to be stopped, even if it meant killing Harris. John Paul Stevens was the lone dissenter. Scalia wrote that Stevens's argument that Harris was not necessarily driving with life-threatening recklessness was so plainly false that anyone with eyes could see so. "We are happy to allow the videotape to speak for itself," Scalia wrote.

Did it? Kahan, Hoffman and Braman showed it to a diverse group of 1,350 Americans. Most of the test subjects saw things as the Supreme Court did: 75 percent concurred that deadly force was justified. The dissenters, however, were not randomly distributed: they reflected distinct subcategories of Americans, like liberal African-American women from cities in the Northeast.

The law professors argued that the justices in the majority were in the grip of a common psychological fallacy: that other people's perceptions might be shaped by socioeconomic position or political commitment, but they themselves perceived the objective truth. The authors recommend that, before summarily deciding a case, "a judge engage in a sort of mental double-check." If he or she can picture a discrete group of Americans who would disagree that a decision is self-evident, go with a jury. To imply that minority groups are flatly unreasonable sends a "denigrating and exclusionary message" and will diminish support for the law. CHRISTOPHER SHEA

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#c

Counterfeit Self, The

ILLUSTRATION BY MR BINGO

Wearing imitation designer clothing or accessories can fool others — but no matter how convincing the knockoff, you never, of course, fool yourself. It's a small but undeniable act of duplicity. Which led a trio of researchers to suspect that wearing counterfeits might quietly take a psychological toll on the wearer.

To test their hunch, the psychologists Francesca Gino, Michael Norton and Dan Ariely asked two groups of young women to wear sunglasses taken from a box labeled either "authentic" or "counterfeit." (In truth, all the eyewear was authentic, donated by a brand-name designer interested in curtailing counterfeiting.) Then the researchers put the participants in situations in which it was both easy and tempting to cheat.

In one situation, which was ostensibly part of a product evaluation, the women wore the shades while answering a set of very simple math problems — under heavy time pressure.

Afterward, given ample time to check their work, they reported how many problems they were able to answer correctly. They had been told they'd be paid for each answer they reported getting right, thus creating an incentive to inflate their scores. Unbeknown to the participants, the researchers knew each person's actual score. Math performance was the same for the two groups — but whereas 30 percent of those in the "authentic" condition inflated their scores, a whopping 71 percent of the counterfeit-wearing participants did so.

Why did this happen? As Gino puts it, "When one feels like a fake, he or she is likely to behave like a fake." It was notable that the participants were oblivious to this and other similar effects the researchers discovered: the psychological costs of cheap knockoffs are hidden. The study is currently in press at the journal Psychological Science.

Could other types of fakery also lead to ethical lapses? "It's a fascinating research question," says Gino, who studies organizational behavior at the University of North Carolina. "There are lots of situations on the job where we're not true to ourselves, and we might not realize there might be unintended consequences." MARINA KRAKOVSKY

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#c

Cows With Names Make More Milk

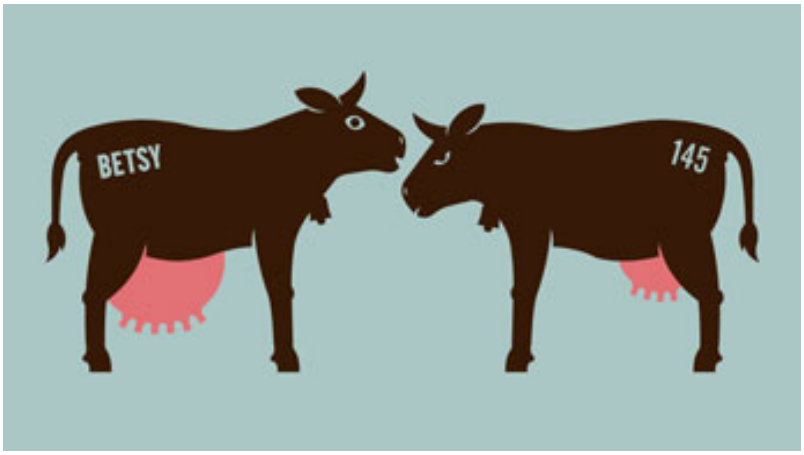


ILLUSTRATION BY JAN KALLWEJT

For dairy farmers, whether to name their cows may seem like a matter of taste. But it might not be. It could be a business decision.

A study of several hundred British dairies published in the journal Anthrozoös in March compared responses to a survey about cow treatment with independently collected milk data and found that cows that have names make, in a given year, about 258 liters more milk per farm than anonymous ones — a bump of about 6 percent.

More research is still needed. The possible psychological effects on cows of having a name, for example, have yet to be determined. But the results so far reveal a correlation: "The naming," says Catherine Douglas, the Newcastle University animal behaviorist behind the research, "reflects the humans' attitudes toward the cows, and therefore how they behave around them." Named cows are more often treated nicely, and well-treated, calm and happy cows make more milk. The point, Douglas says, is that it definitely can't hurt to name your cows.

Naming criteria vary widely. Some farmers name cows alphabetically; others recycle parents' names. Herb and flower names are popular in Britain. "You know," Douglas says, "Daisy, Rose, Buttercup." Douglas once named a cow after her sister, Hattie.

But some American dairy farmers scoff at this idea. Barbara Martin, a third-generation California dairy operator, says naming her 2,200 cows would be completely unrealistic. "Everyone," she says, "has an ear tag with a number." PAT WALTERS

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#c

Cul-de-Sac Ban, The

ILLUSTRATION BY LAUREN NASSEF

Nothing divides suburban developers and "smart growth" advocates as much as the lowly cul-de-sac. The real estate community loves the meandering, dead-end streets; lots on them sell quickly and at a premium, thanks to their low traffic and perceived safety benefits. But critics complain that cul-de-sacs are a poor use of land; they funnel cars onto clogged arterial routes and restrict access to neighborhoods when emergency vehicles need to respond.

For decades the developers have been winning this battle. But this fall, Virginia, under the leadership of Gov. Tim Kaine, became the first state to severely limit cul-de-sacs from future developments. New rules require that all new subdivisions attain a certain level of "connectivity," with ample through streets connecting them to other neighborhoods and nearby commercial areas.

If subdivisions fail to comply, Virginia won't provide maintenance and snowplow services, a big disincentive in a state where the government provides 83 percent of road services.

Virginia expects the new rules to relieve its strained infrastructure budget: through streets are more efficient and cheaper to maintain, and they take pressure off arterial roads that otherwise need to be widened. "It's about connecting land-use and transportation planning and restricting wasteful and unplanned development," Kaine said in March.

And how will the people respond who actually have to live and drive in the new, cul-de-sac-free neighborhoods? "There are pros and cons," says Kaid Benfield, the director of the Smart Growth Program at the Natural Resources Defense Council. "Residents like walkability and they like not having to be forced onto an arterial road where the traffic jam is. On the other hand, there is a sentiment out there that cul-de-sacs are safe" — though Benfield says research actually shows fewer traffic fatalities occur on connected roads. Other states are watching the Virginia rules closely, and Benfield says he expects to see similar regulations adopted around the country in the next few years — which means the dead end may soon be a thing of the past. CLAY RISEN

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#c

Drunken Ultimatums

The so-called ultimatum game contains a world of psychological and economic mysteries. In a laboratory setting, one person is given an allotment of money (say, $100) and instructed to offer a second person a portion. If the second player says yes to the offer, both keep the cash. If the second player says no, both walk away with nothing.

The rational move in any single game is for the second person to take whatever is offered. (It's more than he came in with.) But in fact, most people reject offers of less than 30 percent of the total, punishing offers they perceive as unfair. Why?

The academic debate boils down to two competing explanations. On one hand, players might be strategically suppressing their self-interest, turning down cash now in the hope that if there are future games, the "proposer" will make better offers. On the other hand, players might simply be lashing out in anger.

The researchers Carey Morewedge and Tamar Krishnamurti, of Carnegie Mellon University, and Dan Ariely, of Duke, recently tested the competing explanations — by exploring how drunken people played the game.

As described in a working paper now under peer review, Morewedge and Krishnamurti took a "data truck" to a strip of bars on the South Side of Pittsburgh (where participants were "often at a level of intoxication that is greater than is ethical to induce") and also did controlled testing, in labs, of people randomly selected to get drunk.

The scholars were interested in drunkenness because intoxication, as other social-science experiments have shown, doesn't fuzz up judgment so much as cause the drinker to overly focus on the most prominent cue in his environment. If the long-term-strategy hypothesis were true, drunken players would be more inclined to accept any amount of cash. (Money on the table generates more-visceral responses than long-term goals do.) If the anger/revenge theory were true, however, drunken players would become less likely to accept low offers: raw anger would trump money-lust.

In both setups, drunken players were less likely than their sober peers to accept offers of less than 50 percent of the total. The finding suggests, the authors said, that the principal impulse driving subjects was a wish for revenge. CHRISTOPHER SHEA

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#d

Empty Beer Bottles Make Better Weapons

PHOTO ILLUSTRATION BY REINHARD HUNGER
SET DESIGN BY SARAH ILLENBERGER

Stephan Bolliger is one of Switzerland's leading forensic pathologists, and he often appears in court to testify as an expert witness. He isn't stumped very often by the questions he is asked, but it happened last year, with this one: can a beer bottle, when used as a weapon, put a crack in the human skull? To find out, Bolliger set up an experiment, the results of which were published in The Journal of Forensic and Legal Medicine in April. Other scientists had already calculated how much energy it takes to crack the human skull — between 14 and 70 joules, depending on the location — so all Bolliger needed to do was to take the same measurements on a beer bottle. "If the bottle is more sturdy than the skull," he says, "then the bottle will win, and the skull will break." Simple as that.

Bolliger, who is head of forensic pathology at the University of Bern, went to the store and picked up 10 half-liter bottles of Feldschlösschen Original — his nation's most popular brew. He emptied six of them, left four full and, using a precisely calibrated energy-measuring device, started dropping a steel ball on the bottles from various heights. Bolliger's conclusion: Full bottles shatter at 30 joules, empties at 40, meaning both are capable of cracking open your skull. But empties are a third sturdier.

Why the difference? The beer inside a bottle is carbonated, which means it exerts pressure on the glass, making it more likely to shatter when hitting something. Its propensity to shatter makes it less sturdy — and thus a poorer weapon — than an empty one. As for the ubiquitous half-full bottle, if you hold it like a club, Bolliger says, "it tends to become an empty bottle very rapidly."

Now that we have scientific proof of the skull-crushing potential of glass beer bottles, should breweries switch to softer materials, like aluminum or plastic? Bolliger says he hopes not. "Beer," he says, "just tastes better out of glass." PAT WALTERS

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#e

Forensic Polling Analysis

NATE SILVER**ILLUSTRATION BY CATH RILEY**

The American Association for Public Opinion Research censured a Georgia-based firm called Strategic Vision L.L.C. in September for failing to reveal information about how it conducted its polls during the 2008 presidential race. The company's chief executive promptly threatened to sue, which struck Nate Silver, a polling specialist and political blogger, as a bizarre response.

Wondering if the company had anything to hide, Silver, the proprietor of fivethirtyeight.com, stayed up all night keying all of Strategic Vision's poll results over the last four years into a Microsoft Excel spreadsheet.

To test the polls, Silver made use of a statistical truism. As he puts it, "Tell a human to come up with a set of random numbers, and they will be surprisingly inept at trying to do so." They unwittingly fall into nonrandom patterns.

Silver took the results of every Strategic Vision poll question — from more than 100 polls on political races and issues of every sort — and analyzed the "trailing digits" in the results. (If a poll found that one candidate led another by 52-48, the trailing digits were 2 and 8.) Silver thought that, given the wide range of poll topics, the distribution of trailing digits should be more or less random. Instead — shades of "C.S.I." — he found a highly abnormal distribution of digits. For example, there were nearly 60 percent more 8s than 2s.

The probability of such a distribution occurring in authentic polls, Silver calculated, was "millions to one against." Silver concluded that the firm's data were not random. "It's not close to random," he wrote. "It's not close to close."

When readers asked for a comparison study, he presented a similar analysis for the well-respected Quinnipiac poll. In that case, there were "a few too many 2s and 3s," but nothing outside the realm of chance.

In the coup de grâce, a retired physics professor at the University of Illinois, Michael Weissman, stepped in, deploying more sophisticated tools (Fourier analysis). If Strategic Vision's polls were legitimate, Weissman concluded, the odds that they would produce the numbers

Strategic Vision published were 1 in 5,000 — better than Silver found, but still suspicious. Strategic Vision has threatened to sue Silver, too, but the company has yet to release documentation of its methods. CHRISTOPHER SHEA

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#f

Glow-in-the-Dark Dog, The

PHOTO ILLUSTRATION BY REINHARD HUNGER
SET DESIGN BY SARAH ILLENBERGER

In April, the world was introduced to Ruppy, the first known fluorescent dog. In natural light, Ruppy seems to be an almost-normal beagle — though his paws look as if he has stepped in pink ink. Under ultraviolet light, the effect is quite evident: he emits an eerie red glow.

Ruppy is the first transgenic puppy, which means that he has genes taken from another species. His red fluorescent luminosity comes from the gene of a sea anemone: the gene was introduced into a dog's skin cell; the nucleus was then cloned and transferred to another dog's egg cell, which was then fertilized and eventually became Ruppy. In what is perhaps a stab at genetic humor, his name is also a hybrid, having been formed by combining "Ruby" and "Puppy."

Scientists performed the experiment to demonstrate the feasibility of cross-species implants of genes that control for a specific trait (in this case, fluorescence). The hope is that transgenic dogs can now be created to acquire specific human diseases, which will make them valuable biomedical research subjects. Transgenic mice are already in widespread use, but because rodents are so different from humans, they can be difficult to conduct tests on.

CheMyong Jay Ko, a fertility researcher at the University of Kentucky in Lexington and one of the team members responsible for Ruppy's creation, says there is another reason he would rather use transgenic

dogs in his studies than mice: he can measure the hormones of the dogs without having to kill them. "I use more than 1,000 mice each year," Ko says, explaining that his team has to kill the mice in order to draw their blood for research. Unlike the rodents, Ruppy can provide useful scientific knowledge without necessarily having to sacrifice his life. EMILY BIUSO

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#g

Good Enough is the New Great

"Cheap, fast, simple tools are suddenly everywhere," Robert Capps of Wired magazine wrote this summer in an essay called "The Good-Enough Revolution." Companies that had focused mainly on improving the technical quality of their products have started to notice that, for many consumers, "ease of use, continuous availability and low price" are more important.

High-definition televisions have turned every living room into a home cinema, yet millions of us choose to watch small, blurry videos on our computers and our mobile devices. Cameras capture images in a dozen megapixels, yet Flickr is filled with snapshots taken with phone cameras that we can neither focus nor zoom. And at war, a country that has a fleet of F-16 fighter jets that can cover 1,500 miles an hour is now using more and more remote-controlled Predator drones that are powered by snowmobile engines.

Lo-fi solutions are now available for a range of problems that couldn't be solved with high-tech tools. Music played from a compact disc is of higher quality than what comes out of an iPod — but you can't easily carry 4,000 CDs with you on the subway or to the gym. Similarly, a professional television camera will produce a higher-quality image than a phone, but when something important happens, from the landing of a jet on the Hudson River to the murder of an Iranian protester, and there are no TV cameras around, images recorded on phones are good enough.

In February, a music professor at Stanford, Jonathan Berger, revealed that he has found evidence that younger listeners have come to prefer lo-fi versions of rock songs to hi-fi ones. For six years, Berger played different versions of the same rock songs to his students and asked them to say which ones they liked best. Each year, more students said that they liked what they heard from MP3s better than what came from CDs. To a new generation of iPod listeners, rock music is supposed to sound lo-fi. Good enough is now better than great. ROBERT MACKEY

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#g

Google Algorithm as Extinction Model, The

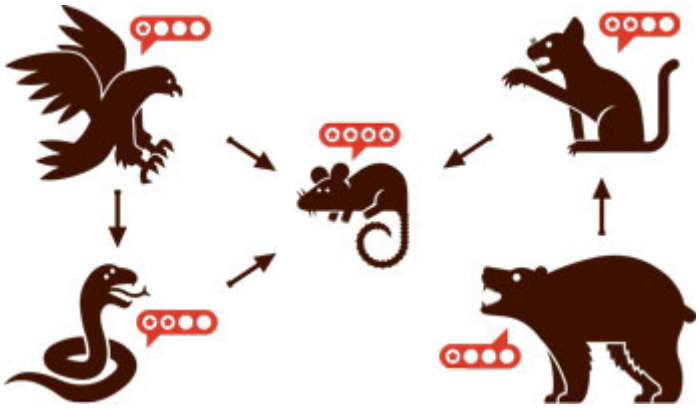


ILLUSTRATION BY JAN KALLWEJT

Every species — be it earthworm or great white shark — is entwined in a vast and complicated system of predator and prey called a food web. To determine which species in a food web are most important to the survival of the larger ecosystem, scientists design computer programs to model how the extinction of a given species would affect the other species in the system. This year, two scientists announced that they had found an unexpectedly useful tool for this purpose: the seminal Google search algorithm.

Stefano Allesina of the University of Chicago and Mercedes Pascual of the University of Michigan began with a simple hunch. Google's search engine uses an algorithm called PageRank to identify the most important Web sites on a given topic by analyzing links: a Web page is important if other important pages link to it. How different is this, really, Allesina and Pascual wondered, from an ecosystem, in which a species is important if other important species eat it?

Allesina and Pascual borrowed Google's PageRank algorithm and modified it to model ecosystems in the natural world. As they explained in September in the journal PLoS Computational Biology, the modified algorithm was more efficient than existing ecosystem-extinction models at identifying which species' extinction would cause the greatest number of

other species in the food web also to go extinct. "Our algorithm is faster and computationally simpler," Allesina says.

The PageRank algorithm could be useful in analyzing other networks too. The world features countless interconnected systems ranging in size from the minuscule (metabolic networks within a single cell) to the immense (international financial markets). After publishing the paper, Allesina received e-mail messages from dozens of researchers interested in adapting the PageRank algorithm. "PageRank is a technique for finding hidden flows in huge quantities of data," says Yonatan Zunger, a Google software engineer who used to work on search technology and who contacted Allesina after seeing his research. "There are all kinds of networks. PageRank is enormously applicable beyond the Web." MALIA WOLL

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#g

Gourmet Dirt

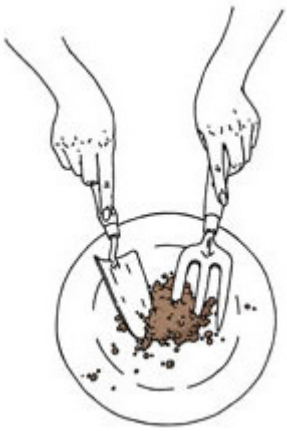


ILLUSTRATION BY MR BINGO

Laura Parker, an artist and agricultural activist based in Northern California, asked a friend late last year to raise a 320-pound pig on his farm to see if its flavor would match that of the dirt it grew up on. In May, Parker and her friends butchered, slow-cooked and ate the pig while smelling soil from the same farm. At first, they were skeptical that they would recognize similarities between the dirt and the pig, which had been fed strictly local produce, bread and goat whey. But "it was harmony," Parker says. Just to be sure, they tasted the pork while smelling soil from other farms, and it was obvious: in those other cases, there was no match. "Grassy" and "creamy" are common terms for wine tasting, but now they're being used to describe flavors of soil. Parker has held many similar tastings — primarily in art galleries, free to the public — with fresh dirt from local farms. "Soil is the basis of everything we eat," she says.

During the tastings, Parker spoons dirt into stemmed wineglasses and adds a small amount of water — essentially making mud — to release the soil's aroma.

Tasters bury their noses in the wineglasses and sniff deeply. The dirt's vapor molecules fall on the backs of tasters' palates, and they taste what they smell. "It's just like when you walk out after it rained," Parker says, "and you say, 'Oh, my God, that smells vibrant.' "

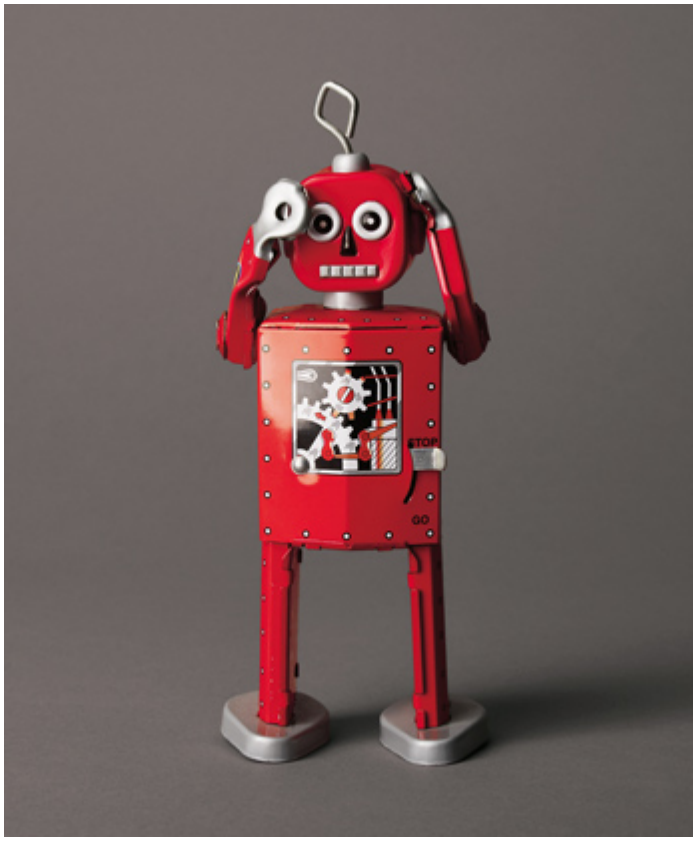
After the soil smelling, she pairs the dirt with food from the same farm — collard greens, squash, radishes, even eggs and goat cheese. The tasters are quizzed to see if they can isolate the same flavors they savored in the dirt — earthy, peppery, citrusy — to demonstrate the connection between what people eat and where it's grown. Next year, Parker will still hold her traditional tastings, but looking to this year's pig as an example, she wants to think of new ways to eat dirt. DARA KERR

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#g

Guilty Robots

PHOTO ILLUSTRATION BY REINHARD HUNGER
SET DESIGN BY SARAH ILLENBERGER

Wars are increasingly being fought by machines. Since 2004, the number of unmanned systems deployed in Iraq, for example, has gone from less than 200 to more than 18,000. Considering how difficult it is for human soldiers to reliably make rational, ethical and legal decisions in the heat of combat, the rise of battlefield robots may seem a cause for concern.



But imagine robots that obey injunctions like Immanuel Kant's categorical imperative — acting rationally and with a sense of moral duty. This July, the roboticist Ronald Arkin of Georgia Tech finished a three-year project with the U.S. Army designing prototype software for autonomous ethical robots. He maintains that in limited situations, like countersniper operations or storming buildings, the software will actually allow robots to outperform humans from an ethical perspective.

"I believe these systems will have more information available to them than any human soldier could possibly process and manage at a given point in time and thus be able to make better informed decisions," he says.

The software consists of what Arkin calls "ethical architecture," which is based on international laws of war and rules of engagement. The robots' behavior is literally governed by these laws. For example, in one hypothetical situation, a robot aims at enemy soldiers, but then doesn't fire — because the soldiers are attending a funeral in a cemetery and fighting would violate international law.

But being an ethical robot involves more than just following rules. These machines will also have

something akin to emotions — in particular, guilt. After considering several moral emotions like remorse, compassion and shame, Arkin decided to focus on modeling guilt because it can be used to condemn specific behavior and generate constructive change. While fighting, his robots assess battlefield damage and then use algorithms to calculate the appropriate level of guilt. If the damage includes noncombatant casualties or harm to civilian property, for instance, their guilt level increases. As the level grows, the robots may choose weapons with less risk of collateral damage or may refuse to fight altogether. DARA KERR

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#g

Heritage Chic

JAKE GUEVARA/THE NEW YORK TIMES

The Great Depression inspired American fashion this year, from men's wear by John Bartlett that looked like a stylized version of Lewis Hine's New York to frocks by Ralph Lauren that wouldn't feel out of place in a Dorothea Lange photograph. Meanwhile, off the runways, many sturdy American outerwear and workwear brands that were actually around during the Depression were enjoying their own unlikely upscale revival. Call it heritage chic.

The progressive clothing boutique Opening Ceremony, which was already using for its own house line fabrics from Pennsylvania's Woolrich, America's oldest continuously operating wool-clothing manufacturer (est. 1830), sought this year to further reimagine classic American clothing. It designed new collections in collaboration with Pendleton, the hundred-year-old Oregon company famed for its woolen shirts, and with the venerable footwear companies Keds (est. 1916) and Timberland (est. 1952).

Humberto Leon, a founder of Opening Ceremony, recalls that executives at Pendleton were at first taken aback by his store's interest in their wares. "They said, ‘This is very different from a lot of the clothing you carry,'" he remembers. "And we said: ‘We know. It's perfect.'"

Eventually, Opening Ceremony's desire to relate the Pendleton tradition to its fashion-forward customer led to a partnership that translated Pendleton's trademark Navajo jacquards and madras prints into slim urban cuts.The Timberland collaboration also yielded a contemporary interpretation of a classic — a convenience boot that combines Timberland's preppy three-eyelet lug and six-eyelet wheat construction boot.

A similar impulse recently prompted the whimsical New York men's wear designers Duckie Brown to mine the archives of the Wisconsin-based shoe company Florsheim (est. 1892) to create a new laceless wingtip and star-spangled Patriot boot. The Japanese designer Daiki Suzuki, who has been creating modern updates on the Woolrich catalog as head of the firm's upscale men's wear label Woolrich Woolen Mills, says that some credit for these new takes on old styles goes to Europe and Japan, where Americana has been fashionable for a generation. "It's not a trend," he insists. "It's more like a style. It's basics."
JESSE ASHLOCK

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#h

Hourglass Surfboard, The

PHOTOGRAPH BY NICK ALLEN

The classic longboard is an elongated, slightly concave ovoid, a shape that has changed little since surfing was invented by the ancient Hawaiians. But the Swedish designer Thomas Meyerhoffer's longboard, introduced in the spring, has a corseted waist and a narrow tail, with a bottom that is more deeply contoured than a typical board. All that curvaceousness is meant to lend the maneuverability of the shortboard, typically ridden by skilled surfers, to the more stable longboard.

Curves have always come naturally for Meyerhoffer, who created the biomorphic eMate laptop, Apple's predecessor to the iBook, and the beanbaglike Chumby, the first "soft" computer. After leaving Apple in the late '90s, Meyerhoffer embraced surfing. He started with longboards but soon began wanting a more agile ride, so he tried alternatives like the fish, a shortboard with a swallowtail. None could match the momentum he felt cresting a wave with the big plank of a longboard beneath him, however. His designer's curiosity piqued, he began wondering how he could make the longboard do more.

The answer came through subtraction. Since the longboard is ridden from the front or the back, Meyerhoffer reasoned that he could reduce mass from its midsection, giving his board its sinuous hourglass shape and making it lighter and easier to pilot while paddling for a wave.

He tried eliminating the tail entirely but found he needed it to balance the rounded nose; instead he tapered it to a point, preventing the tail from getting caught so the rider doesn't lose speed on a turn. He also slimmed the rails — the board's edges — from soft and thick at the hips to a thin, sharp line at the tail, helping to draw water over the planed surface while gripping the wave from the back.
For the longboard, Thomas Meyerhoffer reduced mass from the midsection, tapered the tail to a point and slimmed the rails (the board’s edges).

Many seasoned surfers initially rejected Meyerhoffer's board on sight. But former pros have since championed it, younger riders have won competitions with it and several production runs sold out quickly. "I hope it will be the ignition for more new ideas coming from other shapers," Meyerhoffer says.
JESSE ASHLOCK

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#h

Infant Sleep Is Destiny

ILLUSTRATION BY MARC JOHNS

Attention, anxious parents with sleepless newborns: It's even worse than you think! You already know that a baby with poor sleep habits means misery for you and doesn't seem like much fun for him or her. But this year, evidence emerged that those sleepless nights may also be a sign of bigger troubles to come. According to a new study, erratic sleep patterns in the first 18 months of life correlate at age 2 with reduced "executive functioning" — the term psychologists use to refer to the ability to focus your thoughts, control your impulses and avoid distractions. And executive-function abilities in childhood, recent research has determined, predict future success in school and in life.

Annie Bernier, a psychologist at the University of Montreal; Stephanie M. Carlson, a psychologist at the University of Minnesota; and two colleagues followed 60 families with new babies, and at 12 and 18 months asked them to keep a "sleep diary" tallying how many hours the babies slept at night and during the day. (They decided not to use total hours slept as their measure of sleep quality, because babies gradually need less sleep as they grow. Instead, the researchers postulated that sleeping more hours at night and fewer during the day, as older children do, was a sign of better, more "mature" sleep patterns in infants.)

Earlier research showed that sleeplessness hampers cognitive skills in the short term for both children and adults — an all-nighter before a big exam is almost always a bad idea. But no one had measured the long-term effect of early sleep deficits. So Bernier and Carlson followed the same families over an extended period, and when they tested the children's executive-function abilities at 26 months, they found lingering effects of early sleep troubles.

Bernier and Carlson theorize that early sleep problems may be caused in part by certain parental behaviors, but precisely which behaviors and how they correlate to sleep isn't yet clear. Which is more comforting news for desperate parents to contemplate while singing lullabies and sipping coffee at 3 a.m.: your baby's sleep troubles are quite possibly your fault, but no one can tell you what you're doing wrong. Sweet dreams! PAUL TOUGH

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#i

Killer Earth

ILLUSTRATION BY ANDREW BLAUVELT

The Gaia hypothesis, proposed by the British scientist James Lovelock in the 1970s, states that life preserves the conditions for its own survival. Just as plants breathe out oxygen and humans breathe it in, the whole biosphere keeps the chemistry of air, oceans and soil in a balance that allows life to flourish. The entire planet works together as a giant living organism.

Peter Ward, a paleontologist at the University of Washington who specializes in mass extinctions, this year expressed a dimmer view of life on earth. He sees not a self-optimizing biosphere but a tangle of organisms that have evolved to starve their competitors and pollute their surroundings, behaving in ways that are "inherently selfish and ultimately biocidal." In his book "The Medea Hypothesis," named after the Greek mother who slaughtered her own children, Ward argues that for billions of years the biosphere has been its own worst enemy. "Life seems to be actively pursuing its own demise," he wrote recently in New Scientist, "moving earth ever closer to the inevitable day when it returns to its original state: sterile."

According to Ward, the mayhem started soon after the emergence of bacteria billions of years ago, which choked the earth's atmosphere first with a heat-reflecting haze of methane and then, a billion years later, with dangerous levels of oxygen, which at the time was toxic to life. Soon after, plants sucked up so much carbon that temperatures plummeted, creating a pair of deep ice ages. Of the five great extinctions since the rise of animals, Ward claims, four were caused not by volcanoes or by meteors but by life itself. To top it off, biomass has been declining for the last billion years.

After the current round of man-made global warming, both Ward and Lovelock predict that our descendants will eventually confront a long-term drop in carbon dioxide that threatens to wipe out all plant life within roughly a billion years. Grim as it may seem, a Medean perspective could help us avoid environmental guilt and nostalgia as we face these crises. "We must overcome nature," Ward writes, and later continues, "We do not want to go 'back to nature.'" JASCHA HOFFMAN

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#k

Kitchen Sink That Puts Out Fires, The

House fires are most likely to begin in the kitchen. Yet aside from expensive sprinkler systems, the only tool for fighting kitchen conflagrations is the common fire extinguisher, which some risk assessors consider a fire hazard itself, because it encourages untrained people to battle the blaze rather than to evacuate. What's more, over the last two decades many countries have phased out one of the most effective extinguishers because it uses the ozone-depleting chemical halon.

Yusuf Muhammad and Paul Thomas, industrial-design students at London's Royal College of Art, learned this after a school assignment prompted a conversation with members of the Chelsea Fire Station. The firefighters mentioned water mist, a firefighting technology used on oil rigs and cruise ships because of its advantages in a confined space. After picking the brains of specialists at the conference of the International Water Mist Association, the duo began prototyping a low-cost means of taking water mist into the family kitchen.

Their patent-pending product, Automist, consists of a ceiling-mounted heat detector that triggers a pump under the sink that sends water to a special unit at the base of the kitchen faucet.

There, six high-pressure nozzles emit jets of mist that rapidly turn to steam, creating an inert atmosphere that starves the fire of oxygen and reduces the heat of the room. "It's almost like being in a wet sauna," Muhammad says.

In tests conducted in a roughly 13-feet-by-13-feet space, the duo found the system could contain any type of blaze (including oil fires) in less than five minutes. After winning the James Dyson Award for emerging designers in September, Muhammad and Thomas are now working to get to market by summer a commercial version of Automist, which a licensed plumber will be able to install with any standard faucet. JESSE ASHLOCK

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#k

Literary Alzheimer's

AGATHA CHRISTIEILLUSTRATION BY CATH RILEY

Did Agatha Christie, who wrote several dozen mystery novels during her 53-year career, suffer from Alzheimer's-related dementia? Though some of her biographers have suspected as much, actual evidence was advanced in March by a research team led by Ian Lancashire and Graeme Hirst, professors at the University of Toronto, in a paper called "Vocabulary Changes in Agatha Christie's Mysteries as an Indication of Dementia."

The professors digitized 14 Christie novels (and included two more available in the Gutenberg online text archive), and then, with the aid of textual-analysis software, analyzed them for "vocabulary size and richness," an increase in repeated phrases (like "all sorts of") and an uptick in indefinite words ("anything," "something") — linguistic indicators of the cognitive deficits typical of Alzheimer's disease. The results were statistically significant; Christie's lexicon decreased with age, while both the number of vague words she employed and phrases she repeated increased. Her penultimate novel, "Elephants Can Remember," exhibits a "staggering drop in vocabulary" — of 31 percent — when compared with "Destination Unknown," a novel she wrote 18 years earlier. For Agatha Christie fans, the findings may be proof of a truth they have long recognized: the author's final two books, written in her early 80s, do not hold up against her earlier ones.

Christie's body of work lends itself to such analysis because it spans the bulk of an adult life, from age 28, when Christie wrote her first novel, to age 82, when she wrote her last. Still, Hirst cautions, "the question is not early style versus late style, but the late style of someone who is elderly but healthy versus the late style of someone who is elderly but not cognitively healthy." To contextualize their evidence, Lancashire and Hirst plan to analyze the work of P.D. James, a still-healthy writer who has continued to publish into her 80s, as well as the writings of authors like Ross Macdonald who are known to have had Alzheimer's.
AMANDA FORTÍN

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#l

Lithium in the Water Supply

PHOTO ILLUSTRATION BY REINHARD HUNGER
SET DESIGN BY SARAH ILLENBERGER

America has been adding fluoride to its public water supplies for decades, based on overwhelming evidence that even low levels of the substance can significantly reduce tooth decay, with no major side effects. Now research from Japan suggests expanding the list of aqueous additives — namely, to lithium.

Lithium often occurs naturally, in trace amounts, in water supplies, particularly in areas with a high concentration of granite. In The British Journal of Psychiatry earlier this year, the neuropsychiatrist Takeshi Terao and other researchers showed that communities in Japan's Oita Prefecture with higher levels of naturally occurring lithium in their water supplies had fewer suicides than those with lower levels. The amounts range between 0.7 and 59 micrograms per liter. Lithium in prescription doses (say, 600 to 900 milligrams) helps reduce mood swings in patients with bipolar disorder, but Terao and his colleagues speculate that drinking even small amounts over time has a cumulative effect, building up a resistance to the onset of mood swings in the first place. The researchers note that more work is needed before public-policy makers can consider adding lithium to water supplies. Lithium, after all, can be toxic, and though the levels in the Oita study are too low to have an immediate effect, the element can affect kidney function and cause long-term health problems. "I think we need to be wary of introducing something across the board, because it does take time to work out what the side effects are," says Sophie Corlett, director of external relations at Mind, a British mental-health organization.

Nevertheless, Terao and his team contend that the lithium levels in their study are low enough not to cause significant side effects, and that in any case the benefits outweigh the risks. In a follow-up paper, they even posited that adding lithium to drinking water could "potentially offer an easy, cheap and substantial strategy for worldwide suicide prevention." But Corlett remains wary. "Mass inoculations of one sort or another always seem to be the easy answer, but we shouldn't assume that's the case," she says — especially because "lithium isn't a very friendly drug." CLAY RISEN

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#l

Lunar Legalism

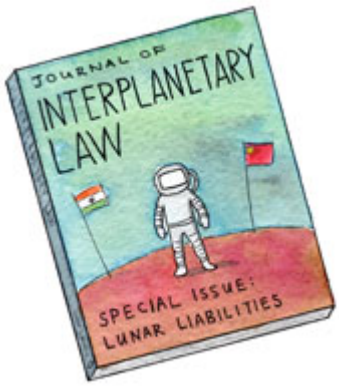


ILLUSTRATION BY MARC JOHNS

Can you own property on the moon? The earth's satellite became abruptly more economically valuable this year, when a NASA probe crashed into the lunar surface and discovered copious amounts of frozen water, a crucial precondition for anyone who wants to establish a base there. There would be military benefits to a moon base, but perhaps more important, there would be commercial ones too: the moon now offers tantalizing mining opportunities, including huge quantities of helium 3, which could be used to generate energy on earth.

Many countries and for-profit firms are eyeing the moon. China crashed a probe into the moon's surface in March, and Richard Branson plans to take tourists there on Virgin Galactic.

But if you set up shop on the lunar surface, what are your legal rights? Last winter, Virgiliu Pop, a researcher at the Romanian Space Agency, began circulating his book, "Who Owns the Moon?" Technically, the moon is covered by what is known as the Outer Space Treaty, which has been signed by spacefaring nations; while the treaty prohibits "national appropriation" of the moon, it is silent on private-sector property rights. The so-
called Moon Treaty, another legal instrument, outlaws private property on the moon — but it hasn't been ratified by any of the major spacefaring nations. The upshot, Pop argues, is that the moon is currently a commons: anyone can use it, but nobody can own it or any part of it.

Pop predicts that the commons approach will erode as soon as someone starts digging into the lunar soil for profit. Indeed, he favors this: he suspects the likeliest way for humanity to unlock the value of the moon is via the "frontier" approach. As in the Wild West, private explorers could stake a claim and work their plot of land, and governments would come along later to enforce property rights.

"Where the text of the law is silent, custom is bound to develop," Pop writes. We're in for some deeply weird legal skirmishes in the decade to come. Whoever gets to the moon next could be the one to own it.CLIVE THOMPSON

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#l

Man-Made Greenery

ILLUSTRATION BY NICK KALOTERAKIS

Nature may well be the art of God, but that isn't keeping mere mortals from trying their hand at it. This year, a group of British engineers recommended building a forest of artificial carbon-filtering "trees" across the United Kingdom to combat climate change; and a Brooklyn designer completed a working prototype of leafy-looking solar panels that could one day replace ivy on buildings.

The treelike devices, which were created by Klaus Lackner, a Columbia University geophysicist, resemble giant fly swatters in one design. They use carbon-capture and storage technology similar to the kind that will be deployed at large power plants, but they aim to absorb carbon from dispersed emissions sources, like vehicles and residences, whose mobility or small size makes individual filters impractical or inefficient. This summer, the Institution of Mechanical Engineers estimated that a forest of 100,000 such trees could mop up half the United Kingdom's carbon emissions, making the forest thousands of times more effective than its natural counterparts.

Down the botanical scale from tree to vine is the designer Samuel Cochran's Grow system, a set of leaflike modules that harness both solar and wind energy. Solar panels aren't typically used, as Cochran's are, on the sides of buildings, because they work best when the sun hits them at a 90-degree angle; but Grow's foliagelike shape is designed for capturing oblique light.

1. In one design, the ‘‘trees’’ contain rows of filtration boxes that capture CO2 in the air. 2. An automated process removes the CO2-saturated filtration boxes and lowers them underground. 3. The carbon is removed by an underground cleaning facility and stored elsewhere, while the clean filtration box is returned to its slot in the tree.

And when a breeze rustles Grow's leaves, tiny piezoelectric generators in their "stems" create a small charge.

Neither project presumes to replace nature with Franken-forests. Because of the limits of carbon storage, artificial trees might be effective for only about a hundred years — long enough, according to Tim Fox of the Institution of Mechanical Engineers, to buy time as we wean ourselves off fossil fuels. And Cochran, nostalgic for the creeping vines of his childhood neighborhood, hesitates to claim Grow's superiority over ivy. "We haven't been bad-mouthing the actual plant," he says. MICHAEL SILVERBERG

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#m

Massively Collaborative Mathematics

In January, Timothy Gowers, a professor of mathematics at Cambridge and a holder of the Fields Medal, math's highest honor, decided to see if the comment section of his blog could prove a theorem he could not.

In two blog posts — one titled "Is Massively Collaborative Mathematics Possible?" — he proposed an attack on a stubborn math problem called the Density Hales-Jewett Theorem. He encouraged the thousands of readers of his blog to jump in and start proving. Mathematics is a process of generating vast quantities of ideas and rejecting the majority that don't work; maybe, Gowers reasoned, the participation of so many people would speed the sifting.

The resulting comment thread spanned hundreds of thousands of words and drew in dozens of contributors, including Terry Tao, a fellow Fields Medalist, and Jason Dyer, a high-school teacher.

It makes fascinating, if forbiddingly technical, reading. Gowers's goals for the so-called Polymath Project were modest. "I will regard the experiment as a success," he wrote, "if it leads to anything that could count as genuine progress toward an understanding of the problem." Six weeks later, the theorem was proved. The plan is to submit the resulting paper to a top journal, attributed to one D.H.J. Polymath.

By now we're used to the idea that gigantic aggregates of human brains — especially when allowed to communicate nearly instantaneously via the Internet — can carry out fantastically difficult cognitive tasks, like writing an encyclopedia or mapping a social network. But some problems we still jealously guard as the province of individual beautiful minds: writing a novel, choosing a spouse, creating a new mathematical theorem. The Polymath experiment suggests this prejudice may need to be rethought. In the near future, we might talk not only about the wisdom of crowds but also of their genius. JORDAN ELLENBERG

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#m

Music for Monkeys

ILLUSTRATION BY HIMI KOZUE

When David Teie, a cellist with the National Symphony Orchestra, wanted to test his ideas about where our emotional response to music originates, he decided to try them out on monkeys. He figured that if his theories were right — namely, that our response to the "emotional vocalizations," pulses and heartbeats that we first hear in the womb establishes our sense of music — then he should "be able to write music for another species that's effective for that species." He contacted Charles Snowdon, a psychology professor who ran a colony of cotton-top tamarins in Madison at the University of Wisconsin, who sent him recordings of tamarin calls that demonstrated fear and calm. The fear-based calls "showed evidence of tritones and minor seconds," Snowdon says, and the calming calls had "long slow notes with some nice harmonic structure."

Teie wrote four pieces for cello and voice based on the tamarin vocalizations, two "threat-based" and two "affiliative." So that the tamarins could hear the compositions on their own terms, he sped them up three octaves. Even at human tempo, the threat-based music sounds martial and alien. Teie also chose four pieces originally designed for human listeners and played them to the tamarins for comparison, including bits of Barber's "Adagio for Strings" and Metallica's "Of Wolf and Man." Over two months, seven pairs of adult tamarins heard all eight pieces of music. Monkeys "really don't care much for human music," Snowdon says, and they showed very little response to it, with the weird exception of excerpts from Metallica and "The Grudge," by Tool, both of which soothed the monkeys slightly.

The monkeys responded more profoundly to Teie's music. The threat-based pieces led to "tongue-flicking, head-cocking, scratching," and other signs of anxiety, Snowdon says. The calming music "increased foraging behavior, eating and drinking." As he composed, Teie was careful not to replicate any of the tamarins' natural vocalizations; otherwise the animals might simply respond to what they already knew. Snowdon and Teie published their results online in September in the journal Biology Letters. Teie has since written other examples of "species-specific music" for cats and mustached bats. "It's certainly music," he says. "It's patterned. If I hand it off to other cellists, they can play it." AARON RETICA

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#m

Myth of the Deficient Older Employee, The

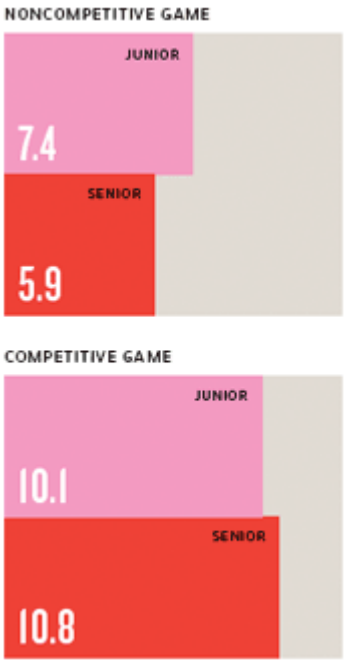


CHART BY LAMOSCA

Although workers who were 45 and older had lower unemployment rates in 2008 than younger workers, they stayed unemployed for longer periods, according to the Bureau of Labor Statistics. This is not surprising. Employers are often reluctant to hire older workers, not only because they have higher health care costs and sometimes command higher salaries but also because of their reputational stigma. Older workers are commonly thought of as being less productive and less willing to learn than younger workers, as well as overly cautious. But this year economists presented a more nuanced picture than the above stereotypes suggest.

In The American Economic Review in June, Gary Charness, an economics professor at the University of California, Santa Barbara, and Marie Claire Villeval, a colleague from the University of Lyon, published the results of a study in which they pitted "seniors" (those over 50) against "juniors" (those under 30) in three different decision-making tasks. These were formulated to test risk taking, competitiveness and cooperation.

As it turns out, the "seniors" more than hold their own. The seniors were also more cooperative, contributing In risk-taking, which the researchers assessed via an investing game, the seniors invested slightly more than the juniors. Seniors (50 and over) performed better than juniors (30 and under) in several tests, including a competitive word game.

more to their group during the cooperation test. The seniors outperformed the juniors on one competitive word game — and were only "very slightly less" competitive overall, Charness says. "Older workers," he stresses, "don't suffer from the deficiencies that a lot of people think they do." Another welcome finding of the study came during the cooperation portion, when Charness and Villeval found that groups with a mix of ages outperformed homogeneous groups. For an optimum work force, Charness says, it is best to have a range of ages in the office. LIA MILLER

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#m

Obama Effect, The

BARACK OBAMA

In 1995, two Stanford psychologists, Claude Steele and Joshua Aronson, demonstrated that African-American college students did worse on tests of academic ability when they were exposed beforehand to suggestions that they were being judged according to their race. Steele and Aronson hypothesized that this effect, which they labeled stereotype threat, might explain part of the persistent achievement gap between white and black students. In the years since, this idea has spread throughout the social sciences. Experimental studies have detected the negative effect of stereotype threat on a wide variety of groups, including women, old people, student-athletes at Swarthmore College and Ecstasy users.

Last year, a week before the Democratic National Convention, David M. Marx, an assistant professor of psychology at San Diego State University, was sitting at a conference with a couple of colleagues when talk turned to the presidential election. What would the rise of Barack Obama, they wondered, do to the stereotype threat experienced by African-Americans? Their idle contemplation quickly turned into a research project, and they quickly designed an experiment to measure what they called the Obama effect. At a series of moments during the 2008 campaign, Marx and his colleagues gave tests of verbal ability to selected black and white students after first priming them to focus on racial stereotypes of academic performance.

ILLUSTRATION BY CATH RILEYIn a paper published this year in The Journal of Experimental Social Psychology, Marx and his colleagues reported that there was indeed an Obama effect, though it had certain limitations. Right after Obama's speech in Denver accepting the Democratic nomination, for instance, the negative effect of stereotype threat was significantly reduced for black students — but for only those who had actually watched the speech. Right after the election, black students again scored better, but at another point in the campaign, there was no measurable effect on their scores.

Other scholars have doubts about the phenomenon. In a separate study published in the same issue of the journal, Joshua Aronson, one of the original Stanford psychologists, found no Obama effect at all. "As much as I believe in the power of role models," Aronson concluded, "I suspect that the greatest contribution Obama will make to narrowing the achievement gap will be his policies, not his persona."
PAUL TOUGH

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#o

Predictive Smiles

ILLUSTRATION BY LAUREN NASSEF

Say cheese and stay married? Yes, according to Matthew Hertenstein, a psychology professor at DePauw University in Greencastle, Ind. He and three colleagues recruited more than 600 people for a review of their college yearbook photos. The researchers rated the yearbook smiles by coding muscle movements around the mouth and the eyes.

The researchers found a surprising correlation: the less people smiled, the more likely they were to later divorce. The effect was statistically significant, though not huge. But when Hertenstein compared the top 10 percent of brightest smilers with the bottom 10 percent of weakest smilers, the "lowest were five times more likely to be divorced than the top."

The researchers also recruited 51 people to submit photos of their choosing. The relationship between smiling and staying married held even for the photographs this group submitted — posed and candid shots from when the subjects were, on average, 10 years old. "I'm more confident in the smiling effect because it held even with a) childhood and b) candid photos," Hertenstein says. Studying smiles in photos is only the latest in what has come to be called "thin slice" research, popularized in the book "Blink," a couple of best sellers ago from Malcolm Gladwell. For example, from very short video clips, research volunteers have determined

with surprising accuracy the personality, socioeconomic status and sexual orientation of those on camera. A still photograph is merely an extremely wafer-thin slice.

The why of the smiling effect remains elusive. Hertenstein acknowledges potentially "dozens" of possible explanations, going with perhaps the most straightforward and benign. He says his "gut inclination is that people who smile on average in their photos have a positive disposition that serves them well in life and relationships."

He cautions that his study is "not destiny." Readers who frowned in their yearbook photos are not putting off the inevitable if they fail to rush to court to file for divorce. "There are plenty of people who defy the odds," offers the professor, only slightly reassuringly. JEFF STRYKER

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#p

Predictive Smiles

ILLUSTRATION BY LAUREN NASSEF

Say cheese and stay married? Yes, according to Matthew Hertenstein, a psychology professor at DePauw University in Greencastle, Ind. He and three colleagues recruited more than 600 people for a review of their college yearbook photos. The researchers rated the yearbook smiles by coding muscle movements around the mouth and the eyes.

The researchers found a surprising correlation: the less people smiled, the more likely they were to later divorce. The effect was statistically significant, though not huge. But when Hertenstein compared the top 10 percent of brightest smilers with the bottom 10 percent of weakest smilers, the "lowest were five times more likely to be divorced than the top."

The researchers also recruited 51 people to submit photos of their choosing. The relationship between smiling and staying married held even for the photographs this group submitted — posed and candid shots from when the subjects were, on average, 10 years old. "I'm more confident in the smiling effect because it held even with a) childhood and b) candid photos," Hertenstein says. Studying smiles in photos is only the latest in what has come to be called "thin slice" research, popularized in the book "Blink," a couple of best sellers ago from Malcolm Gladwell. For example, from very short video clips, research volunteers have determined

with surprising accuracy the personality, socioeconomic status and sexual orientation of those on camera. A still photograph is merely an extremely wafer-thin slice.

The why of the smiling effect remains elusive. Hertenstein acknowledges potentially "dozens" of possible explanations, going with perhaps the most straightforward and benign. He says his "gut inclination is that people who smile on average in their photos have a positive disposition that serves them well in life and relationships."

He cautions that his study is "not destiny." Readers who frowned in their yearbook photos are not putting off the inevitable if they fail to rush to court to file for divorce. "There are plenty of people who defy the odds," offers the professor, only slightly reassuringly. JEFF STRYKER

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#p

Printable Batteries

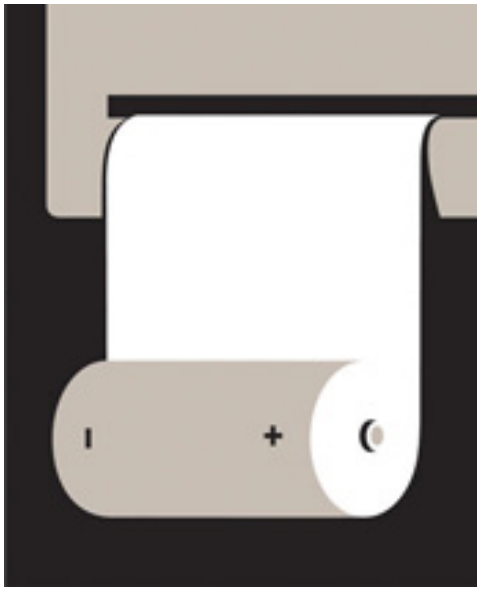


Illustration by Justin Fines.

Though you may not be aware of it, the technology already exists to create a video screen thin enough — and ILLUSTRATION BY NOMA BARflexible enough — to fit seamlessly into the pages of this magazine. Ultrathin electronic devices can be built using a special inkjet printer that squirts fine layers of complex compounds instead of ink. When the compounds dry, they leave behind sheer metallic films, which in the right combination could act as thermometers, light sensors, even computer chips. So why haven't you seen these gadgets yet? In part because they are hard to power: even the smallest lithium-ion watch battery is too bulky.

The solution is to print batteries too. This year, a research team at the Fraunhofer Research Institution for Electronic Nano Systems revealed a 0.6-millimeter-thick battery.

It consists of a stack of metal pastes that act as anode, cathode and electrolyte, bound on top and bottom by carbon layers that collect electricity and deliver it to the attached device. This product can be built right into the device it's powering, as part of the production process, so there's no need for an additional assembly line. And the battery can be made as large or as small as needed, simply by printing more of it. The list of possible applications is endless — from bandages that release medication when they sense an increase in body temperature to wallpaper that changes color at the flick of a switch.

We're not talking megawatts, of course. According to Andreas Willert, one of the researchers, it takes about 15 square centimeters of printable battery to provide the same power as a single watch battery. But 15 square centimeters could be enough to power, say, a blinking magazine cover for a month. The Fraunhofer Research Institution introduced its battery at a nanotech expo in Japan in February. The next step is to open a small production line, which Willert expects will be ready next year. Which means that soon, instead of reading these pages, you might be watching them. CLAY RISEN

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#p

Rainfall Theory of Development, The

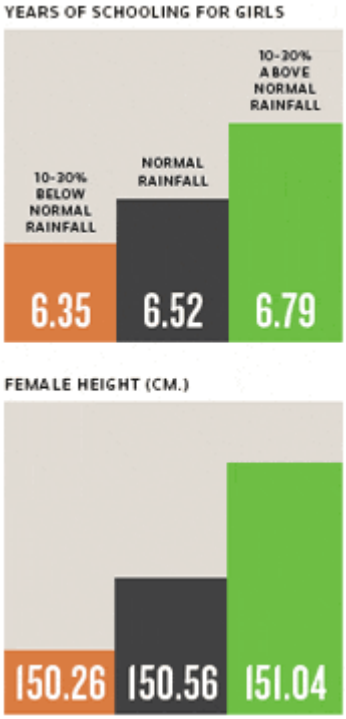


CHART BY LAMOSCA

The amount of rain that fell during your first year of life has affected your education, your health and even how much money you can put your hands on —Dry times are hard times in poor countries, especially for girls.at least if you are a woman who grew up in the countryside in postwar Indonesia. In 2000, for example, rural women between the ages of 26 and 47 who were born in areas with 20 percent higher rainfall than normal the year after they were born were, on average, more than half a centimeter taller than their luckless (and drier) counterparts. These women also went to school for 0.22 grades longer and had more assets. That may not sound like a lot more education, but it means a year more of schooling for every five girls in those rain-enriched areas. And for

every five girls in an area with 20 percent less rainfall than usual, a year of school was lost, compared with women who were born into a year of average precipitation. Just as notable, the Indonesian men who were surveyed showed no rainfall effect either way. Sharon Maccini and Dean Yang, a married pair of economists who teach at the University of Michigan, published their mash-up of local rainfall data with life outcomes in June in The American Economic Review. They point out that "our finding of significant impacts for women and not for men is consistent with gender bias in the allocation of nutrition and other resources, particularly in times of unusual hardship."

Maccini and Yang also demonstrate that rainfall shocks that occurred when children were in utero had no long-term effect on adult men or women in Indonesia, suggesting that the nutritional bias began only when the sex of the child was revealed after birth. Less rice in this critical period can lead to worse health, followed by less schooling and, finally, fewer assets.

Economic growth and better irrigation have probably begun to diminish the rainfall effect in Indonesia, Yang says, but in other areas of the world like sub-Saharan Africa, where "income levels are still very low and people's ability to nourish their kids is almost certainly affected by rainfall fluctuations," it is most likely still going strong. AARON RETICA

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#r

Random Promotions

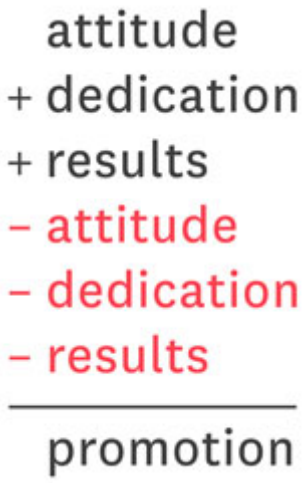


ILLUSTRATION BY OPEN

In 1969, the Canadian psychologist Laurence J. Peter posited the "Peter Principle": people in a workplace are promoted until they reach their "level of incompetence." This happens, Peter argued, because we wrongly assume that people who are good at their jobs will also be good at jobs that are one rung up on the corporate ladder — so we promote them. But often the new job is so different from the previous job that the employee can't handle it. Now performing incompetently, the employee stays in place, dragging the efficiency of the firm downward. Eventually the entire economy becomes like the paper company Dunder Mifflin in "The Office" — clogged with incompetence.

Is there any way to avoid this trap? Yes, by promoting people at random. That's what a trio of Italian scientists discovered this year. They created a computer model of a 160-person corporation and programmed it with Peter Principle-like logic: the best performers were promoted, but they had only a random likelihood of being good at their new jobs. Sure enough, the firm was soon cluttered with incompetents, and its efficiency plunged. But then the researchers tried something different: they reprogrammed the firm so that it

promoted people entirely randomly, and the overall efficiency of the firm improved.

They also tried alternately promoting the absolute best and absolute worst performers. That, too, worked out better than promoting on merit. The scientists say these strategies work because they harness "Parrondo's Paradox," a piece of game theory in which you win by alternating between two losing strategies. "In physics or game theory, this isn't new," says Andrea Rapisarda, a physicist at the University of Catania in Italy and a co-author of the study, which was recently published in the journal Physica A.

As Rapisarda points out, if you could know for sure that the people being promoted would excel in their new jobs, that would be the best strategy of all. But if you aren't sure — and in the real world, we rarely are — then random works better. CLIVE THOMPSON

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#r

Resomation

SANDY SULLIVAN
ILLUSTRATION BY CATH RILEY

The cremation rate has been on a brisk rise in the United States, in part because cremation is cheaper than burial and saves land. But powering a crematorium requires an enormous amount of gas and also sends carbon dioxide and other pollutants skyward. Enter resomation, an alternative to cremation for the eco-conscious cadaver. Resomation is a process that liquefies rather than burns body tissues. It uses about a sixth of the energy of cremation and has a much smaller carbon footprint, according to Sandy Sullivan, the managing director of Resomation, a company in Scotland that has designed a resomation machine. The Mayo Clinic in Minnesota has been using a similar system since 2006 to dispose of donated bodies, but this year the first commercial Resomator is being installed at a funeral home in Florida, one of three states where the process is legal.

Resomation (a neologism meant to suggest rebirth) was first proposed for use in Europe as a method of disposing of cows infected by bovine spongiform encephalopathy. The corpse is placed in a pressurized chamber. The vessel is then filled with water and potassium hydroxide, creating a highly alkaline solution, and heated to 330 degrees. After about three hours, all that's left are a soft, white calcium phosphate from bone and teeth and a light brown primordial soup of amino acids and peptides. Bodies buried underground decompose in the same way, albeit over many years and aided by microorganisms.

Unlike cremation, resomation doesn't vaporize the toxic mercury of dental fillings and doesn't char joint implants, leaving them clean, shiny and potentially recyclable. The bone and tooth material can be ground into a fine ash, as with traditional cremains. The brown liquid, because it's sterile, can go down the drain. "There's no genetic material in it at all; it's just basic organic materials," Sullivan assures. "You might get some people who say they want the fluid as well, but at the end of the day, it's best to send it to the water treatment plant so it ends up back on the land, as nature intended it to." RUTH DAVIS KONIGSBERG

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#r

Reverse-Engineering Social Security Numbers

Keeping your Social Security number (S.S.N.) secure is key to preventing identity theft and fraud. But there have always been bugs in the system. People have known for decades about the conventions that the Social Security Administration uses when issuing S.S.N.'s, and not long ago, scientists figured out how to use this information to determine from a given S.S.N. the birth date of the applicant and the state in which the number was issued. Thankfully, though, the reverse was not true: an unknown S.S.N. could not be determined from that data.

Until now. This year, Alessandro Acquisti, an economist, and Ralph Gross, a computer scientist, both at Carnegie Mellon, announced in The Proceedings of the National Academy of Sciences that they had figured out how to predict a person's S.S.N. Their work was made possible, paradoxically, by steps the government took to prevent identity theft and fraud. Years ago, for instance, the administration decided to make public its Death Master File — the list of every S.S.N. taken out of circulation, together with the name, birth date and state in which the deceased originally applied for a number.

The release of the file was supposed to make it harder for criminals to hijack dead people's S.S.N.'s, since those numbers could be easily cross-checked. But it provided Acquisti and Gross with a data set that they could analyze for patterns in how the numbers are assigned.In addition, starting in 1989 the government encouraged parents to register children with S.S.N.'s at birth — instead of registering them anytime between birth and when they started a job. The intention, in part, was to prevent the theft of numbers that hadn't yet been claimed. One consequence, however, is that S.S.N.'s issued since then are even less randomly assigned than before — and thus easier to crack.

Given a state and birth date, Acquisti and Gross were able to predict correctly all nine digits in an S.S.N. in 1,000 attempts or fewer, 8.5 percent of the time, which renders a sizable percentage of S.S.N.'s about as easy to crack as a three-number PIN. From there, it is possible to use publicly available tools like online instant credit-card approval sites to try combinations until the right number is confirmed. MARK VAN DE WA

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#r

Social Networks as Foreign Policy

ROBERT GATES
ILLUSTRATION BY CATH RILEY

In August, after the suppression of Iran's pro-democracy protests, officials in Tehran accused Western governments of using online social networks like Twitter and Facebook to help execute a "soft coup." The accusation wasn't entirely off-base. In Iran and elsewhere, this year showed the growing importance of social networks to U.S. foreign policy.

Long before the protests in Iran started, the Broadcasting Board of Governors, which oversees U.S. civilian international broadcasting, had in place software to counter censorship in countries like Iran, so people could better access the blogosphere. And the State Department financially supports agencies that make it easier for Iranians and others to surf the Web. After the protests began, the State Department asked Twitter to reschedule a maintenance outage so the activists could continue to spread the word about their movement.

The United States has long disseminated information to people living under repressive regimes — think of Radio Free Europe. The difference here is that the content of the information isn't the important thing; the emphasis is on supporting the technical infrastructure and then letting the people decide for themselves what to say. Communication itself erodes despots' authority. "The very existence of social networks is a net good," says Alec Ross, a senior adviser on innovation to Secretary of State Hillary Clinton.

Outside of Iran, the State Department recently underwrote the establishment of Pakistan's first mobile-phone-based social network, Humari Awaz ("Our Voice"). More than eight million text messages were sent over it in a little over two weeks. And Ross recently traveled to Mexico with the Twitter chairman Jack Dorsey and other technology executives to help build an electronic system for anonymously reporting drug crimes, which they say they hope will undermine narcotics kingpins.

Defense Secretary Robert Gates, who has written about the efficacy of samizdat in undermining the Soviet Union, sees a similar dynamic at work here. "The freedom of communication and the nature of it," he has said, "is a huge strategic asset for the United States." NOAH SHACHTMAN

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#s

Sound Cannon, The

ILLUSTRATION BY NICK KALOTERAKISThe portable Long-Range Acoustic Device (LRAD) can be mounted on a vehicle and used to issue vocal commands or to emit a piercing sound that acts as a crowd deterrent.

The Long-Range Acoustic Device (LRAD) is a powerful loudspeaker that can also emit a sirenlike noise at a volume of up to 152 decibels. According to national regulatory agencies, even seconds-long exposure to sound greater than 140 decibels brings risk of permanent hearing loss. Some people, like the demonstrators who heard it used by police officers this year at the G-20 meeting in Pittsburgh, call the LRAD an acoustic weapon. A spokesman for its manufacturer, American Technology Corporation, calls it a "communication device." But all agree: It's loud.

The LRAD has been on the market since 2003 and has been used by private companies and foreign governments, but it gained new attention this year when the Pittsburgh Police Department used it in what is believed to be the first public deployment of the siren in the United States. (The department says it did not turn the mechanism up to its highest volume.) The LRAD also made a cameo this year on the documentary television show "Whale Wars," when Japanese whalers deployed it against Sea Shepherd, a group of environmental protesters. Despite these controversial uses of the device, Robert Putnam of American Technology maintains that the LRAD is a tool for the public good.

In addition to the siren function, he says, the LRAD can amplify voices, like a supersize bullhorn. He says that the National Guard used the LRAD to communicate with flood victims stranded by Hurricane Katrina, and that it has also been used by wind farmers to keep birds away "to allow us truly renewable green energy without blood-stained turbines."

Putnam says that "there's no denying that there's some bite to that deterrent tone" but maintains it is more humane than rubber bullets or billy clubs. He says that the company knows of no substantiated cases of LRAD-related hearing damage, though he adds, "I don't doubt that someone will claim it." EMILY BIUSO

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#s

Stiletto Claws

PHOTOGRAPH BY DON ASHBY

There are many theories about sartorial behavior as an economic indicator. In dark times, hemlines go down. Lipstick sales go up. And high heels grow ever higher, an attempt to lift our collective spirits by elevating women a few extra inches off the ground. So it was, perhaps, that during Paris fashion week in October, Alexander McQueen sent down the runway lobster-claw ankle booties that were the highest, and probably the strangest, shoes we have seen since the disco footwear of the 1970s. "I don't think it makes sense to play safe in these times," McQueen said in an interview, adding: "The world needs fantasy, not reality. We have enough reality today."

The boots — 12 inches tall, and so arched that the models who wore them appeared to be walking on pointe, like alien ballerinas — were part of McQueen's Spring 2010 collection, "Plato's Atlantis," a dystopian aquatic vision.

The surrealistic clothing, digitally printed with reptilian patterns, was itself something to behold, but as the models teetered along, it was difficult to focus on anything but the footwear. (Miraculously, there were no spills.)

Though a shoe like this would usually provoke the typical feminist debates about high heels, this one stands outside of such human considerations. Dubbed "the armadillo" by McQueen in a Twitter post, the boot transformed the models' feet into hooves, or the claws of some futuristic crustacean.Appropriately so: McQueen, influenced by "On the Origin of Species," presented a kind of evolution in reverse: from the sea we emerged; to the sea we will return.

But the message may also have been more mundane. These are shoes in which form topples function, an extreme version of the increasingly vertiginous — and nearly unwearable — heels that designers have offered for the past year. Indeed, "Can you walk in them?" was the question asked by many women on the Internet. The answer would appear to be: not easily. Though fashion creatures like Daphne Guinness and Lady Gaga have worn them, editors at British Vogue, who test-drove the boots, blogged that they "miserably failed to make it further than the Vogue fashion cupboard." AMANDA FORTINI

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#s

Subscription Artists

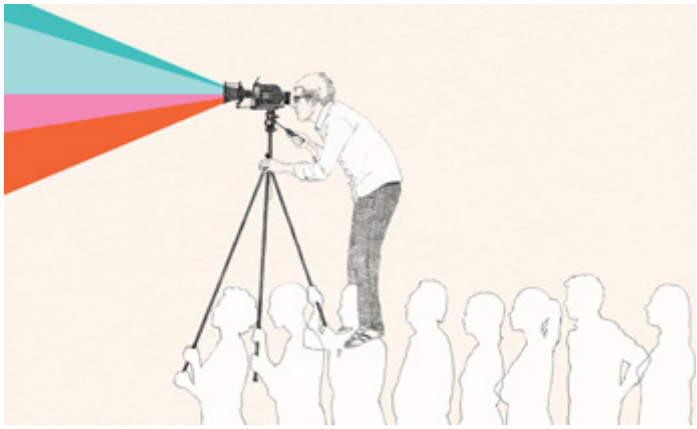


ILLUSTRATION BY LAUREN NASSEF

This summer, Allison Weiss, a 22-year-old singer who writes melodic songs about "hopeless hope," wanted to produce a 1,000-CD run of a new album she was recording, but she wasn't sure how to get the money to do it. Then she heard about Kickstarter, a Web site unveiled in April. At Kickstarter, creative types post a description of a project they want to do, how much money they need for it and a deadline. If enough people pledge money that the artists reach (or surpass) their financial goals, then everyone is billed, paying in advance as you would for a magazine subscription. For goals that aren't reached, nobody is charged.

In essence, Kickstarter offers a form of market research for artists. For perhaps the first time, an artist can quickly answer a nagging question: Does anyone actually want my art badly enough to pay for it? If the goal is reached, the artist now has a list of subscribers to her vision. And if the goal isn't reached? "It's painful, but it's better to find out early," rather than spend precious time and money on a project nobody wants, says Yancey Strickler, who helped found Kickstarter. More than 1,000 projects have been started on Kickstarter since April, raising money for projects as diverse as a solo sailboat trip around the world ($8,142 raised) and a book by Scott Thomas documenting how he developed the graphic design for Barack Obama's presidential campaign ($84,614 raised).

Weiss picked a goal of $2,000, and like many Kickstarter users, offered a clever set of tiered benefits for fans: $40 got someone a signed copy of the album (17 fans paid for that), and for $500, the donor could pick any subject and Weiss would write a song on it. (Two people bit.) Weiss raised the $2,000 in less than 10 hours, and eventually amassed $7,711 from 195 backers, which meant she could pay for more mixing. Perhaps even more important was the validation of her fan base. Weiss says, "I was surprised to find I had a more dedicated Internet following than I thought." CLIVE THOMPSON

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#s

Thirdhand Smoke

PHOTO ILLUSTRATION BY REINHARD HUNGER
SET DESIGN BY SARAH ILLENBERGER

Many parents who light up are aware of the dangers of secondhand smoke; they blow it out the window or smoke at home only when the kids are not there. But people rarely account for what is left behind after a cigarette has been extinguished. When smoke dissipates, it does not just disappear. Compounds are left over that settle on walls, furniture and clothes, or become part of house dust. Call it "thirdhand smoke," which is what a team of researchers trying to raise awareness of the dangers of smoking named it in January.

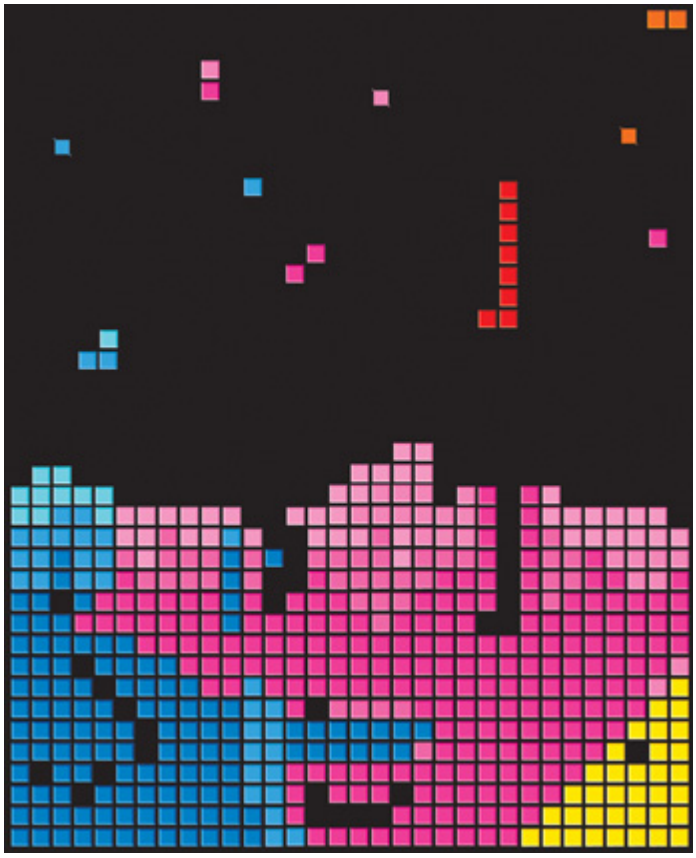
The study, published in the journal Pediatrics, surveyed 1,500 smokers and nonsmokers about the hazards of secondhand and thirdhand smoke and found that 84 percent of smokers believe secondhand smoke is dangerous to children, while only 43 percent think thirdhand smoke is harmful. But the compounds in thirdhand smoke can be ingested or absorbed through the skin, and some give off gases as they deteriorate, says Jonathan Winickoff, an associate professor of pediatrics at Massachusetts General Hospital, who led the research. Many are carcinogenic. "The more you smoke in these locations, the more microlayers of these toxins build up," Winickoff says.

Winickoff is analyzing data on children who live in apartments and encounter thirdhand smoke only from other units in their buildings. He expects to publish his results early next year. LIA MILLER

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#t

Treating P.T.S.D. With Tetris

ILLUSTRATION BY NOMA BAR



Whether it's caused by a car accident or an assault, post-traumatic stress disorder can result in vivid, incapacitating flashbacks of the traumatic moment.

For decades, doctors have tried to treat P.T.S.D. with everything from drugs to complex "desensitization" regimens. This year, a group of British scientists suggested a simpler therapy: playing the video game Tetris.

In an experiment, the scientists had 40 adults watch a 12-minute film filled with graphic scenes of traffic accidents, surgeries and a drowning — material that often produces mild flashbacks even when viewed only in a movie. Half an hour after the film, half the participants were asked to sit quietly for 10 minutes and the other half were asked to play Tetris for 10 minutes. They were then tested to see whether they had any immediate flashbacks; they also kept a journal for the following week in which they recorded any involuntary revisualizing of the imagery.

The group that played Tetris fared far better — experiencing 42 percent fewer flashbacks over one week. "It was so simple, and it worked beautifully," says Emily Holmes, a senior research fellow at the University of Oxford and an author of a paper published in January on the experiment. She calls Tetris a potential "cognitive vaccine" for P.T.S.D.

The scientists suspect the Tetris vaccine works because flashbacks are registered primarily as visual memories. By playing Tetris right after a trauma, the visual cortex becomes so busy that the brain doesn't encode the horrific visual imagery in the way that it otherwise might. (Tetris addicts report seeing the game's bricks falling in their mind when they try to sleep.) And Tetris is nonverbal, so it doesn't impinge upon other crucial work the brain does to help make sense of — and cope with — a traumatic episode. Holmes isn't yet recommending Tetris as a therapy. But if further tests confirm its value, the game could become a formal treatment: to help ease your mind after a trauma, try to manipulate gently falling bricks.
CLIVE THOMPSON

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#t

Undead-Austen Mash-Ups

Publishers in search of a marketing hook aren't above trumpeting even their most middling wares as a mix of Dickens, Chekhov and Dan Brown. This year, a small publishing house in Philadelphia hit on a more effective formula: Take some Jane Austen, add a healthy dollop of gore and start counting the money.

The Austen monster mash-up boom began in April, when Quirk Books published "Pride and Prejudice and Zombies," a version of the 1813 classic fortified with "all-new scenes of bone-crunching zombie mayhem," by a Los Angeles television writer named Seth Grahame-Smith. The book is about 85 percent Jane Austen, with copious added references to cracked skulls and ninja swordplay. (The first line: "It is a truth universally acknowledged that a zombie in possession of brains must be in want of more brains.")

"Pride and Prejudice and Zombies" has spent eight months on the New York Times best-seller list, spawned several imitators and injected some fresh blood — and male readers — into an Austen industry dominated by gauzy romances. Goodbye, "The Private Diary of Mr. Darcy." Hello, "Mr. Darcy, Vampyre," "Sense and

Sensibility and Sea Monsters" and "Dawn of the Dreadfuls," a prequel to "Zombies" that lists Austen as an author despite the lack of what Hollywood types refer to as "participation."

The culture industry has always looked for familiar (and uncopyrighted) works to feed on. But some scholars say it's not such a big leap from Austen's mean-girl wit to real violence. In a way, Austen's novels are already zombie novels, says Brad Pasanek, a specialist in 18th-century literature at the University of Virginia. "They are exercises in what the critic D. W. Harding called ‘regulated hatred.' Austen's prose sublimates satire, anger and pain into polite exchange."

Apparently, unexploited veins of horror lurk in other beloved literary genres as well. Next year, Seth Grahame-Smith goes solo with "Abraham Lincoln: Vampire Hunter," an entirely original work parodying the great-man style of popular history. His editor described it as "a presidential biography in the vein of a Doris Kearns Goodwin or David McCullough," with vampires added only "where they could fit in properly to the actual events of Lincoln's life." JENNIFER SCHUESSLER

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#u

Waste Tracking

VALERIE THOMAS
ILLUSTRATION BY CATH RILEY

The current system of curbside recycling hasn't kept pace with today's stream of high-tech garbage, which increasingly includes hardware that could be salvaged (like cellphone parts) and products that contain toxic materials that could be more safely disposed of (like some fluorescent light bulbs).

But now, a prototype technology called Smart Trash aims to better manage all forms of waste that carry product ID tags. "The whole information system falls off when things are disposed," says Valerie Thomas, a professor of industrial engineering and public policy at Georgia Tech. She is developing the Smart Trash system to fix that.

It begins with a garbage can outfitted with a scanner. When an unwanted item is dropped in, its UPC barcode or radio-frequency identification tag is read — as in the checkout line on the day it was purchased.

The scanner tracks important information like the make, model and component parts and, when Smart Trash is fully operational, will send that data to a waste company's Web site or a site like eBay to determine how much the item is worth to recyclers or in the secondhand market. That data can in turn be downloaded by the garbage collector at pickup, or relayed via a WiFi connection to the waste company, which will distribute the items accordingly — to e-waste handlers, recyclers and secondhand dealers. The user would get money for his trash in the form of rebates or sales proceeds.

If implemented, Smart Trash's combination of a waste-tracking infrastructure and cash-for-trash incentives could help us rethink the garbage dump as a sorting facility like the post office — rather than a final resting place. DANIEL MCGLYNN

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#w

Weapons of Mosquito Destruction

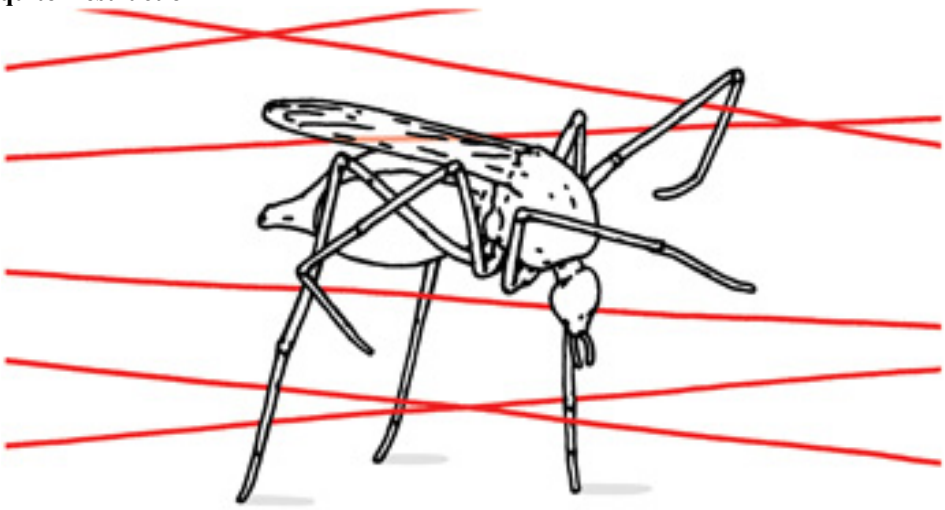


ILLUSTRATION BY MR BINGO

Mosquitoes, though vulnerable as individuals to the swat of a hand, are as a group maddeningly difficult to kill or control. For some of us, this is a source of irritation. But in countries where mosquitoes spread malaria or other diseases, it can be fatal. Though netting and bug sprays offer some help, this year marked the promising advance of higher-tech antimosquito weaponry.

Szabolcs Marka, a Columbia University astrophysicist whose main occupation is searching the universe for black holes, received a grant this year from the Bill and Melinda Gates Foundation to develop a kind of futuristic mosquito net. He and two colleagues are working on a project that creates a "light shield" through which mosquitoes and other airborne insects will not fly. Marka says the project has had promising results. In a series of tests, mosquitoes were released into a box partitioned into halves by a laser beam. The mosquitoes stayed in one-half of the box, treating the laser wall as if it were solid (though it did not constitute an actual physical barrier). Marka envisions his laser shield covering doors and windows or encircling a bed with a cone of invisible light shining down from the ceiling.

Other scientists have also seen the future of mosquito combat in lasers — a field of innovation that this year The Wall Street Journal called "Weapons of Mosquito Destruction," or W.M.D.'s. The company Intellectual Ventures is developing something called the Photonic Fence. Lowell Wood and Jordin Kare, astrophysicists who have worked on the Strategic Defense Initiative, have conceived and developed this scheme, in which mosquitoes are blasted with lasers.

Marka notes that his method has the benefit of not upsetting the ecosystem by killing too many mosquitoes indiscriminately. He says he hopes that before too long he will have "something practical" for sale for around $10. LIA MILLER

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#w

Web Searches in Real Time

When Michael Jackson moonwalked off this mortal coil in June, the outgoing King of Pop unwittingly ushered in a new era on the Internet: the age of real-time search.

If you wanted the scoop on what had just happened that day, the place to look for it wasn't Google News, which featured hours-old stories from The Associated Press and other news wires. The sites to hit were goofy-named start-ups like Topsy, OneRiot and Wowd. These companies crawl social networks like Twitter and Facebook to show you what people are saying right this second and, just as important, what they're linking to.

Instead of 10 blue links to Web pages, real-time search engines interweave video clips, blog posts, breaking news reports and tweets about what some reporter just said on CNN — or TMZ — plus the occasional old link made newly relevant, like a video clip of Jackson's first public moonwalk in 1983. They rank results by how much social-network buzz each item is getting at the moment.

By the early afternoon of June 25, a top result on most real-time search sites was a repeatedly updated blog post by two Los Angeles Times reporters who had access to gossipy first responders and City Hall staffers dealing with the Jackopalypse. Most people outside L.A. most likely wouldn't have thought to go to latimesblogs .latimes.com for confirmation of Jackson's death. But once enough social-network users found the post and began linking to it, the real-time search sites floated it to the top.

Six months later, real-time search is one of the hottest subjects in Internet business, despite the field's lack (surprise!) of a proven way to make money. Microsoft includes traffic from popular tweeters into the search results on its heavily marketed Bing site. Twitter is improving its real-time tools at search.twitter.com. And Google, oddly late to the game, says it is working on integrating real-time updates into its search engine. PAUL BOUTIN

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#w

Zombie-Attack Science

ILLUSTRATION BY MR BINGO

Epidemiologists today worry a lot about swine flu. But earlier this year, Philip Munz got interested in a more devastating possibility: an outbreak of zombies. A graduate student at Carleton University in Ottawa, he was watching a lot of movies about the undead and realized that zombification could be regarded as a classic paradigm of infectious spread: people get bitten by zombies, after which they turn into zombies themselves and start biting others. So Munz decided to use the tools of epidemiology to answer a sobering public-health question: could humanity survive a zombie outbreak?

Working with a professor and two other graduate students, Munz built a mathematical model of a city of one million residents, in which an outbreak occurs when a single zombie arrives in town. He based the speed of zombie infection on the general rules you see in George Romero movies: after getting bitten, people turn into zombies in 24 hours and sometimes don't realize what's happening to them until they change.

When he ran the model on a computer, the results were bleak. "After 7 to 10 days, everyone was dead or undead," he says. He tried several counterattacks. Quarantining the zombies didn't work; it only bought a few extra days of survival for humanity. Even creating a "cure" for zombification led to a grim result. It was possible to save 10 to 15 percent of the population, but everyone else was a zombie. (The cure in his model wasn't permanent; the cured could be rebitten and rezombified.)

There was only one winning solution: fighting back quickly and fiercely. If, after the first zombies emerge, humanity begins a policy of "eradication," then the zombies can be beaten. This is, as Munz points out, what traditionally saves humanity in zombie flicks. "People finally realize what's happened," he says, "and they call the army in." Or as he concludes in his paper on the work, to be published in the collection "Infectious Disease Modelling Research Progress": "The most effective way to contain the rise of the undead is to hit hard and hit often." CLIVE THOMPSON

http://www.nytimes.com/projects/magazine/ideas/2009/?ex=1276059600&en=3315a37210ca3555&ei=5087&WT.mc_id=GN-D-I-NYT-MOD-MOD-M127-ROS-1209-HDR&WT.mc_ev=click#z

Can't find the words? Google with a photo instead

- 14:30 08 December 2009 by **Duncan Graham-Rowe**

Where am I? (Image: Travelpix Ltd?Getty)
Smartphone users no longer need to think up an appropriate phrase when searching the web on the go – at least, not if they are using Google's Android operating system.

"You take a picture of an item and use that picture as the query," explains Vic Gundotra, one of Google's vice presidents for engineering.

The service, called Goggles, attempts to identify the object – for example, it might recognise a landmark like the Golden Gate bridge in San Francisco – and returns a page of conventional search results, as if a user had typed the name of the landmark. Goggles can also identify artworks and extract the text from a photo, for example of a business card. It might find places to buy a product you've seen or identify local attractions.

When a user takes a photograph, Goggles sends the image to a Google server where it is analysed by algorithms looking for "signatures" of objects within the image, says Gundotra. The signature is then compared against a database of more than a billion images.

"The best matches are ranked and sent back down to your device, all in a fraction of a second," says Gundotra.

Point, shoot, buy

Goggles is not the first visual search engine, nor is it the first available as a mobile app. Since 2006 Bandai Networks, the largest cellphone applications provider in Japan, has enabled users to buy products such as CDs by taking photos of them. The system uses software developed by Evolution Robotics in Pasadena, California.

The usefulness of searching visually was always going to come to Google's attention, says Paolo Pirjanian, Evolution Robotics' president and CEO.

"It makes it possible to do a lot more than you can describing something by words alone," he says. "It is an obvious next step for search."

A mouse pointer for the world

Google's product is tailored to work best on certain types of object, such as landmark buildings, says Gundotra, but the goal is to identify any object in any image. "It will be as simple and easy as pointing at an object. You will be able to treat it like a mouse pointer for the real world."

However, Google has set itself some limits, to fend off privacy fears.

"While we have the underlying computer science technology to do facial recognition, we have decided to delay that," Gundotra says, citing privacy concerns. Google acquired face-recognition technology developed by Neven Vision in 2006.

http://www.newscientist.com/article/dn18251-cant-find-the-words-google-with-a-photo-instead.html?DCMP=NLC-nletter&nsref=dn18251

Early birds may have dropped teeth to get airborne

- 12:32 08 December 2009 by **Colin Barras**

Holotype of Zhongjianornis yangi gen. et sp. nov. (Image: Zhonghe Zhou and Fucheng Zhang Zhiheng Li)

Fad dieting wasn't an option in the Cretaceous, so the earliest birds went to more extreme measures to address weight issues: they lost their teeth.

Archaeopteryx, at 150 million years old still the oldest known bird, had an imposing set of teeth. But within 20 million years, at least some birds were toothless. Now a team led by Zhonghe Zhou at the Chinese Academy of Sciences in Beijing believe they know why.

They discovered *Zhongjianornis yangi*, a toothless bird from 22 million years ago in China's Liaoning province. Their analysis shows that *Z. yangi* belonged to one of four bird groups that independently lost their teeth, implying that this loss was no evolutionary fluke. *Z. yangi*'s group is the most primitive among them, suggesting it could provide clues as to why tooth loss occurred.

The team compared the body structure of a number of early birds and found that some toothed species were more adapted for flight. They think natural selection may have put pressure on weaker fliers to lose their teeth in a bid to improve their skills by losing excess weight. "It would be especially advantageous to reduce the weight of the head because [it] is further from the centre of gravity," they write.

That theory is "as good as any other", says Mike Benton at the University of Bristol, UK, though he remains sceptical. "Losing teeth wouldn't make a huge difference to balance in the air."

Journal reference: *Proceedings of the Royal Society B*, DOI: 10.1098/rspb.2009.0885

http://www.newscientist.com/article/dn18248-early-birds-may-have-dropped-teeth-to-get-airborne.html?DCMP=NLC-nletter&nsref=dn18248

Innovation: Making a map for everyone, by everyone

- 13:06 08 December 2009 by **Paul Marks**

A map that everyone can add to (Image: Daniel Grill/Getty)
Innovation is our regular column that highlights emerging technological ideas and where they might lead

Crowdsourcing a map of the world, and letting anybody edit it, might sound supremely democratic, but until now it has been a largely exclusive game. Unless you're familiar with cartographic jargon, you haven't been able to play.

That's a pretty big obstacle for the OpenStreetMap project, which wants to generate a map that no government agency (such as the British Ordnance Survey) or commercial entity (Nokia, Tom-Tom, Google and the like) could claim any rights to.

The project kicked off in 2004 and can boast some 180,000 contributors, who have slowly been building the map. But that progress could be supercharged by improvements in cellphone technology and a slew of new apps that can turn anyone into a cartographer.

Power to the people

Typically, OpenStreetMap enthusiasts walk, hike, cycle, drive or even sail around so-far unmapped locales using handheld satnavs to mark the coordinates of points of interest, which they then enter on OpenStreetMap's website. But it's a big planet – and progress is patchy. While some areas like the UK and Germany are mapped in fine detail, other nations such as Italy have scant data on areas outside the big cities.

Software that makes it easier to create and edit OpenStreetMap could encourage more people in more countries to get involved, says Nick Black, a co-founder of CloudMade of Menlo Park, California, which creates mapping apps and development software.

"People know every nuance of the roads and footpaths near their homes and workplaces. They can spot inaccuracies a mile off. But making changes by going in and editing roads has not been easy," says Black.

Opening up

Indeed, OpenStreetMap's editing page had this writer lost. Options included unexplained acronyms with meanings known only to the cognoscenti. Drawing a new thoroughfare requires foreknowledge

of the nomenclature: you need to know that you must assign it the description "main road", "secondary road" or "footpath".

"The map needs opening up to a whole new set of users," says Black.

His answer is Mapzen a free web-based utility. With intuitive, easy-to-understand menus, it links into OpenStreetMap's database via your login credentials. And usability is to the fore: it's perfectly clear that to edit the point at which a motorway hits a main road, you just hit a button marked "motorway". I edited a London street that I knew to be wrongly shaped – a T-shaped cul-de-sac, not a plain dead end – in a couple of minutes.

Despite the need for global take-up, Mapzen will only be available with English menus and, from mid 2010, in German. "However, we will over the next few months be launching a website where people can contribute code to enable multiple language versions of Mapzen to be created," says CloudMade spokesman Paul Jarratt.

Smartphones, neat apps

The tech is going mobile, too. Instead of wandering around with satnavs and entering the data later, you can do the lot with a GPS-equipped iPhone using CloudMade's Mapzen Point-Of-Interest Collector. This free app puts the usability of Mapzen into a peripatetic form and allows, say, a cyclist to stop at a newly discovered bike-parking rack – gold dust in an unknown city – and enter its location as a point of interest on the OpenStreetMap database. I tried that, too, and it works.

As the OpenStreetMap project adds more granular detail to its maps, its usefulness will grow alongside ever-improving cellphone technology. Plans are already afoot to port the Mapzen POI Collector to the raft of phones baseed on the Google-led Android operating system, for instance.

And the iPhone 3GS, which has a compass built in, is a good example of an improved device that will take great advantage of OpenStreetMap. Because the phone knows its orientation relative to a map, geosoftware maker Curly Brackets of Cologne, Germany, has developed Ubique, an app for the iPhone 3GS that projects a small version of the OpenStreetMap in your locale onto the road view in front of you.

It shows you the road turnings and points of interest directly ahead of you – and allows Wikipedia entries on landmarks to pop up, too. It does look slightly messy but it's compelling – and it is the first app I've seen that makes me feel like upgrading from an iPhone 3G to a 3GS.

As the free-to-use OpenStreetMap grows, so will the scope of the web and phone apps available for it. And unlike users of OpenStreetMap, this technology doesn't know where it is going. But as far as I'm concerned, that's a good thing.

http://www.newscientist.com/article/dn18249-innovation-making-a-map-for-everyone-by-everyone.html?DCMP=NLC-nletter&nsref=dn18249

Stephen Wolfram: 'I'm an information pack rat'

- 09 December 2009 by **David Cohen**
- Magazine issue 2738.

Providing the answers, or peddling nonsense? (Image: Megan Bearder)

Stephen Wolfram *reckons he can model the entire universe using tiny computer programs. But despite being the creator of a "search engine" that provides answers, he still has to convince his peers that he's on the right track, as* ***David Cohen*** *discovers*

IT WAS the summer of 2002 when Stephen Wolfram received an "incredibly emotional" phone call. "You are destroying the heritage of mathematics that has been built up since Greek times," said the flustered caller. Wolfram listened with a mixture of dismay and bemusement, then shot back that, on the contrary, he had made his millions from building on that heritage. "He's a famous physicist, that's all I can tell you," Wolfram says across our table in the Colonial Inn, a faux British pub in his home town of Concord, Massachusetts - his choice of venue.

Wolfram guards his privacy jealously. When we arranged to meet he refused to let me come to his house and suggested the pub. When I arrived I was guided to a spartan back room containing a table, two chairs and a tray of cakes. Wolfram stumbled in a few minutes later in a manner you'd expect of a fusty university professor, not a thrusting multimillionaire owner of a technology corporation. "I suppose I must be in the right place," he said rather sheepishly. His voice is soft and low, almost a whisper, and he retains a British lilt though his accent occasionally drifts into a mid-Atlantic twang.

"I started subscribing to your magazine when I was 8 years old," he says, disarming me immediately. The flattery doesn't last long. "I noticed that a few years back you guys went through a bad patch," he says. "My main conclusion was that if there was a story about something in *New Scientist* then it had to be nonsense." I laugh nervously.

The more vociferous of Wolfram's critics might say he's been peddling his own form of nonsense since 2002 and, as the phone call demonstrates, they're not afraid to tell him. That call came shortly after Wolfram's book, *A New Kind of Science* (*NKS*) was published. The book was nothing if not controversial. Taking more than a decade to write, the self-published work made claims that, by his own admission, were extraordinary. It created a minor storm in academic circles. "I think my idea is fairly big, and I thought that if I started out saying 'this is a big deal' people would get it."

NKS is Wolfram's manifesto for what he sees as a new approach to understanding the world. It was born of his interest in little computer programs called cellular automata - these are essentially lists of rules that describe the ways in which a system can change state given a set of initial conditions. In its

simplest form, a cellular automaton can be a grid of black or white squares, with a list of rules defining under what conditions a square is to change from white to black. With just a few rules, it is possible to generate extremely complex patterns that look like leaves or snowflakes. This led Wolfram to wonder if cellular automata could be used to model many other - even all - natural phenomena.

NKS is his investigation into this unorthodox approach to science. What makes it unorthodox is that instead of using formulae and equations as mathematical models of the real world, Wolfram claims a far better way to model the world is to use these tiny computer programs. Unfortunately, the idea flies in the face of millennia of scientific thought. Freeman Dyson, the eminent physicist at the Princeton Institute for Advanced Study, famously gave the book a one-word review: "Worthless."

So far *NKS* has failed to set the world alight, but this doesn't bother Wolfram; he says he's playing the long game. "I think it's still early days for developments to come out of *NKS*. It's going to be a decade or two before things happen." Meanwhile, Wolfram has high expectations for his next project. "I want to find the fundamental theory of physics," he says, by modelling the universe using the ideas roughed out in his book.

This would sound like the ravings of a madman were it not for Wolfram's impeccable credentials. Born in 1959, he won a scholarship to Eton College at the age of 12, became interested in particle physics aged 14 and two years later wrote a paper that was published in a prestigious journal (*Australian Journal of Physics*, vol 28, p 479). At 17 he went to the University of Oxford, but left two years later to take up a research post at the California Institute of Technology in Pasadena. By the age of 20 he was working alongside legendary physicists Richard Feynman and Murray Gell-Mann. He won a MacArthur "genius" award a year later. "If I can't understand something, then it's probably nonsense," he says.

If I can't understand something, then it's probably nonsense
Around that time he drifted away from particle physics and began work on cellular automata. He claims to be single-handedly responsible for bringing the field back into fashion. This interest has dominated the last 28 years of his life. It led him to develop *Mathematica*, popular software that allows scientists and engineers to program and manipulate formulae and equations, and display their results in a myriad ways. It made his fortune.

In 1991 he retreated into a decade-long, hermit-like existence during which he wrote *NKS*. "I did do something a bit bizarre at that time in that I said I wasn't going to deal with the outside world. I had to really focus," he says. Even today his only hobby is going to the cinema: "Usually on Friday evenings I go out to see a trashy movie. I view it as being a way I connect and find out what's going on in the world at large."

Throughout our conversation, two Dictaphones have sat between us, only one is mine. "I'm an information pack rat," he confesses. Recording our interview is just the tip of his peculiar obsession with documenting every moment of his life. "I have a keystroke logger that has collected my every keystroke for the last 22 years," he says. "Every day I get an email that tells me how many keystrokes I typed the previous day into each application. I find it slightly interesting." He shrugs off my suggestion that it's a way of securing his immortality; he believes that soon everyone will be doing it.

Hoarding information is precisely what Wolfram is now doing on a much larger scale. In May he launched WolframAlpha, which he describes as an "answers engine". Unlike web search engines, WolframAlpha doesn't try to return relevant web pages to a particular search term. Instead it treats your query as a question and attempts to compute an answer using its massive and growing internal databases.

"It's completely different to a search engine. It's a much higher bar to say 'we want to get the answer'." I ask why typing in *New Scientist* returns no meaningful results. He doesn't believe me and whips out

his iPhone to check. "You're right," he says, taken aback, "It hasn't worked. It knows about a lot of periodicals but that's shocking. We should fix that."

Whilst he continues to iron out the glitches in WolframAlpha, the physicist is continuing to work on his unifying theory of everything by way of cellular automata. I ask if he's disappointed that his old academic colleagues didn't take to his idea more openly. "I think I perhaps had a higher opinion of a lot of science and physics types than I should have done," he says. In spite of the negativity, we might not have to wait that long for the final verdict. Wolfram claims to have already found a model which describes the universe, even containing something that looks like general relativity. "I would give myself even odds of succeeding," he says.

Profile

Stephen Wolfram set up Wolfram Research and produced the computer programming package *Mathematica*. In May his company launched the website wolframalpha.com, which attempts to answer a user's questions by analysing a huge database of facts

http://www.newscientist.com/article/mg20427381.100-stephen-wolfram-im-an-information-pack-rat.html?DCMP=NLC-nletter&nsref=mg20427381.100

Psychiatry's civil war

- 09 December 2009 by **Peter Aldhous**
- Magazine issue 2738..

WHEN doctors disagree with each other, they usually couch their criticisms in careful, measured language. In the past few months, however, open conflict has broken out among the upper echelons of US psychiatry. The focus of discord is a volume called the *Diagnostic and Statistical Manual of Mental Disorders*, or *DSM*, which psychiatrists turn to when diagnosing the distressed individuals who turn up at their offices seeking help. Regularly referred to as the profession's bible, the *DSM* is in the midst of a major rewrite, and feelings are running high.

Two eminent retired psychiatrists are warning that the revision process is fatally flawed. They say the new manual, to be known as *DSM-V*, will extend definitions of mental illnesses so broadly that tens of millions of people will be given unnecessary and risky drugs. Leaders of the American Psychiatric Association (APA), which publishes the manual, have shot back, accusing the pair of being motivated by their own financial interests - a charge they deny. The row is set to come to a head next month when the proposed changes will be published online. For a profession that exists to soothe human troubles, it's incendiary stuff.

Psychiatry suffers in comparison with other areas of medicine, as diseases of the mind are on the whole less well understood than those of the body. We have, as yet, only glimpses into the fundamental causes of the common mental illnesses, and there are no biological tests to diagnose them. This means conditions such as depression, schizophrenia and personality disorders remain difficult to diagnose with precision. Doctors can only question people about their state of mind and observe their behaviour, classifying illness according to the most obvious symptoms.

We have only glimpses into the causes of mental illnesses and there are no biological tests for them First published in 1952, the *DSM* has its origins in a book used by the US military to determine if recruits were mentally fit for combat. The difficulty of separating mental disorders from normal variation in behaviour made it controversial from the start. Over the years, the book's influence has grown, and today it is used by doctors across the globe.

The wording used in the *DSM* has a significance that goes far beyond questions of semantics. The diagnoses it enshrines affect what treatments people receive, and whether health insurers will fund them. They can also exacerbate social stigmas and may even be used to deem an individual such a grave danger to society that they are locked up.

Some of the most acrimonious arguments stem from worries about the pharmaceutical industry's influence over psychiatry. This has led to the spotlight being turned on the financial ties of those in charge of revising the manual, and has made any diagnostic changes that could expand the use of drugs especially controversial. "I think the DSM represents a lightning rod for all kinds of groups," says David Kupfer of the University of Pittsburgh, Pennsylvania, who heads the task force appointed by the APA to produce the revised manual.

Few would claim that the *DSM*'s current version is perfect. With each revision, the number of conditions it defines has swelled, many surrounded by bewildering lists of symptoms that must be checked to assign a diagnosis. Using current *DSM* checklists, for example, 114 different combinations of symptoms can lead to a diagnosis of schizophrenia. At the same time, many patients prove hard to fit into the framework.

One aim of the work groups compiling *DSM-V* is to cut through this chaos. They are streamlining diagnoses by removing various subtypes of schizophrenia, for example, and intend to address the confusion created by the fact that many people with one condition meet criteria for other disorders as

well. The *DSM-V* task force is expected to propose a series of "dimensions" to be considered with a patient's main diagnosis. So as well as deciding whether someone has, say, bipolar disorder, doctors would determine whether they are suffering from problems such as anxiety and sleeping disturbances, and assess them on a simple scale of severity.

Grandiose claims

This is widely seen as a first step towards a future in which psychiatric diagnosis has a more scientific base, where sprawling checklists of symptoms are replaced by sliding-scale measurements of the underlying determinants of mental health. Yet critics worry that even a limited embrace of this "dimensional" approach is running ahead of the science. Until we understand more about the biological basis of psychiatric disease, this approach will not be helpful, they say.

Some of the harshest criticisms have come from those who led previous revisions of the *DSM*, in 1980 and 1994. In July, Robert Spitzer and Allen Frances, both now retired, wrote a stinging letter to the APA, accusing it of planning unworkable changes and making grandiose claims. In a separate editorial in the magazine *Psychiatric Times*, Frances complained that most of the authors are university-based researchers who are cut off from typical doctors and patients.

Spitzer and Frances also criticise the fact that members of the various *DSM-V* work groups have had to sign confidentiality agreements. "The main problem is that we don't know what they're doing," says Spitzer. The APA says the confidentiality agreements are to stop the manual's authors writing their own diagnostic handbooks alongside the official manual. Kupfer points out that discussion does go on: work groups proposing major changes debate their ideas in papers and at meetings. "We've done everything we can to encourage it," he says.

Another focus for Spitzer and Frances's concern is the suggestion that *DSM-V* could include new categories to capture milder forms of illnesses such as schizophrenia, depression and dementia. "The result would be a wholesale... medicalization of normality that will lead to a deluge of unneeded medication," Frances said in his editorial.

For example, one work group is considering whether it is possible to catch people in the early stages of schizophrenia or other psychotic illnesses before they have their first full-blown psychotic episode (*Schizophrenia Bulletin*, vol 35, p 841). Some doctors prescribe antipsychotic drugs at this early stage in the hope of stopping the illness from progressing.

Libido loss

These medicines can have serious side effects, such as loss of libido, weight gain and distressing tremors and spasms, so no one would want to take them without good reason. Yet it's hard to separate distressed people who will go on to develop a psychotic disorder from the "false positives" - those who will recover or develop a different illness. The available evidence suggests that only about 30 per cent of people identified as being at risk of psychosis will go on to develop it within two years.

These medicines can have serious side effects so no one wants to take them without good reason Nevertheless, William Carpenter, a psychiatrist at the University of Maryland in Baltimore who chairs the *DSM-V* work group on psychosis, believes the needs of the "true positives" are so great that adding a diagnostic category to cover "psychosis risk" would, on balance, be a good thing. Frances brands this proposed diagnosis as "the most worrisome suggestion entertained".

Given the controversy, psychosis risk may not make it into the *DSM* proper, and may instead appear in the appendix, as a condition needing more research. But even that designation might boost prescribing.

Frances and Spitzer are not the only ones with concerns, and there are other flashpoints (see "Hebephilia", "Transgendered" and "Bereavement"). In March, Jane Costello of Duke University in Durham, North Carolina, resigned from the work group on disorders in childhood and adolescence, worried about what she saw as a lack of scientific rigour across the whole *DSM* revision. "I felt that there was not enough empirical work being achieved or planned," she says.

The disputes are getting ugly. Senior APA figures have even suggested that Spitzer and Frances are motivated by a desire to safeguard their flow of royalties from clinical guides linked to the current *DSM*. "The fact that Dr. Frances was informed... that subsequent editions of his *DSM-IV* associated products would cease when the new edition is finalized, should be considered when evaluating his critique," leading APA figures said in a response to Frances's editorial.

Spitzer and Frances reject this charge. "To suggest that I have no concern other than the royalties is a little absurd," says Spitzer. "My annual royalties from *DSM-IV* related books are $10,000 per year," notes Frances. "These have nothing to do with concerns I expressed."

Attention has also turned to the financial interests of those working on *DSM-V*. The APA has ruled that members of the task force and work groups may not receive more than $10,000 per year from industry while working on *DSM-V*, and must keep their stock holdings below $50,000. This doesn't satisfy Lisa Cosgrove of the University of Massachusetts, Boston, who studies financial conflicts in psychiatry (*New Scientist*, 29 April 2006, p 14). She notes that the APA's ruling places no limit on industry research grants, and has found that the proportion of *DSM-V* panel members who have industry links is exactly the same as it was for *DSM-IV*, at 56 per cent (*The New England Journal of Medicine*, vol 360, p 2035).

The final version of *DSM-V* is scheduled to be published in 2012, but given the level of controversy and the need to test whether psychiatrists can reliably use the proposed diagnoses, that date seems certain to slip.

For now, there is an uneasy ceasefire, but next month the work groups will post their proposed changes on the APA's website. Stand by for renewed hostilities.

Hebephilia

How young is too young?

You may have never heard of "hebephilia", but this obscure diagnosis has huge significance in the courts. If it becomes accepted it could lead to hundreds of sex offenders who have served their jail time being locked up indefinitely - on grounds that some say are spurious.

Hebephilia refers to when adults are sexually fixated on teenagers around the time of puberty. This sets it apart from paedophilia, which refers to a focus on pre-pubescent children. The *DSM-V* work group on sexual disorders is likely to call for paedophilia to be renamed paedohebephilia, and include a hebephilic subtype.

The justification is the research of one work group member, Ray Blanchard of the University of Toronto in Canada. Working with sex offenders, Blanchard used a device that records blood flow in the penis to measure their arousal while they were listening to sexual material. He concluded that some men have a disorder that causes them to fixate on girls aged 11 to 14 (*Archives of Sexual Behavior*, vol 38, p 335).

The proposed diagnosis has been condemned by critics as dangerously blurring the boundary between paedophilia and normal male attraction to teenage girls - which isn't necessarily acted upon. Karen Franklin, a forensic psychologist in El Cerrito, California, argues that the diagnosis makes a disease

out of preferences that have been shaped through human evolution. "People didn't used to live so long and mating started earlier," she says.

The work group is also considering whether some men are specifically turned on by rape - a proposed condition termed paraphilic coercive disorder. Again, the evidence is based largely on measurements of penile blood flow in response to sexual images and stories, and the validity of the condition is hotly contested.

The rows over hebephilia and paraphilic coercive disorder aren't academic, because 20 US states have passed laws that allow sex offenders who have served their sentences to be detained indefinitely in a secure hospital if they are deemed "sexual predators" (*New Scientist*, 24 February 2007, p 6). This can only be done if the offenders have a psychiatric disorder that increases their risk of reoffending - which few do, according to *DSM-IV*.

Franklin says that if hebephilia and paraphilic coercive disorder make it into *DSM-V*, they will be seized upon to consign men to a lifetime of incarceration. This argument cuts little ice with Blanchard, however. "The clinical facts are what they are," he says.

Transgendered

We are who we say we are

Is history repeating itself? That's the question facing psychiatrists considering how gender identity should be defined in *DSM-V*. The APA has a legacy of uneasy relations with the lesbian, gay and transgender community, having included homosexuality in the *DSM*'s list of psychiatric disorders until 1973. Some transgender activists want issues of gender identity kicked off the list of mental illnesses too.

These activists are up in arms over the membership of *DSM-V*'s sexual and gender identity disorders work group, in particular the selection of Kenneth Zucker of the University of Toronto, Canada, as its chair. Zucker is reviled by some transgender activists for his work on therapy to reorient children who feel that they were born into the wrong sex. An online petition objecting to the work group's composition has more than 9500 signatures.

The group is nevertheless likely to recommend changes that could actually ease tensions. One of these is a change in the name of a diagnosis that as currently phrased is inherently offensive to transgender people. "'Gender identity disorder' falsely implies that the gender identities of gender variant people are in themselves disordered," says Kelley Winters, founder of GID Reform Advocates.

The work group has not yet revealed its proposed name, but "disorder" will be dropped. "We're sensitive to issues of language," says Zucker. One possibility is "gender dysphoria", which focuses on the inherent distress of people living in a body that doesn't match their identity.

That would not satisfy those transgender activists who want issues of gender identity removed from the *DSM* altogether. But others argue for the retention of a renamed condition to make it easier for those distressed by the mismatch between their identity and their bodies to seek assistance, and also to help those who need sex-change surgery to get it paid for. Even now, many transgender people face problems when insurers refuse to recognise the treatment as a legitimate medical expense.

Bereavement

When does grief become an illness?

Losing a loved one is the most devastating event that most people ever experience, yet the official diagnosis of depression specifically excludes people who have recently been bereaved. Now there may be a major shift.

Not only is bereavement a known trigger for depressive symptoms, but bereaved people respond just as well to antidepressant treatment as others with similar symptoms, says Jan Fawcett of the University of New Mexico, Albuquerque, who heads the *DSM-V* work group on mood disorders. He thinks it may be time to class people who are severely distressed due to a recent bereavement as depressed.

For most people time proves at least a partial healer. But about 10 per cent of bereaved people are still debilitated by their loss more than six months later - and they can remain locked into this loop of grief for many years. Acknowledging their plight, the proposals for *DSM-V* are expected to include a new diagnosis of "complicated grief" or "prolonged grief syndrome".

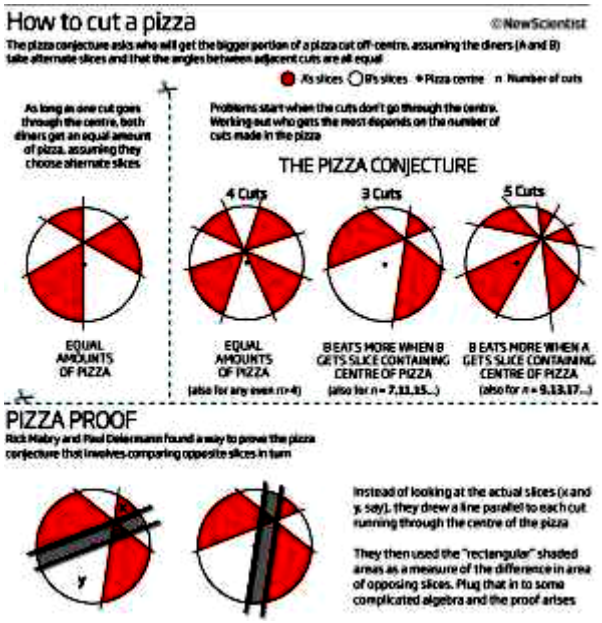
The impetus for this comes from a team led by Holly Prigerson of Harvard Medical School in Boston, who has shown the condition can be reliably diagnosed (*PLoS Medicine*, vol 6, p e1000121). Katherine Shear, now at Columbia University in New York, has also found that the condition responds well to a form of psychotherapy designed to help bereaved people begin resuming their lives (*Journal of the American Medical Association*, vol 293, p 2601).

Peter Aldhous is New Scientist's San Francisco bureau chief

http://www.newscientist.com/article/mg20427381.300-psychiatrys-civil-war.html?DCMP=NLC-nletter&nsref=mg20427381.300

The perfect way to slice a pizza

- 09 December 2009 by **Stephen Ornes**
- Magazine issue 2738..



LUNCH with a colleague from work should be a time to unwind - the most taxing task being to decide what to eat, drink and choose for dessert. For Rick Mabry and Paul Deiermann it has never been that simple. They can't think about sharing a pizza, for example, without falling headlong into the mathematics of how to slice it up. "We went to lunch together at least once a week," says Mabry, recalling the early 1990s when they were both at Louisiana State University, Shreveport. "One of us would bring a notebook, and we'd draw pictures while our food was getting cold."

The problem that bothered them was this. Suppose the harried waiter cuts the pizza off-centre, but with all the edge-to-edge cuts crossing at a single point, and with the same angle between adjacent cuts. The off-centre cuts mean the slices will not all be the same size, so if two people take turns to take neighbouring slices, will they get equal shares by the time they have gone right round the pizza - and if not, who will get more?

Of course you could estimate the area of each slice, tot them all up and work out each person's total from that. But these guys are mathematicians, and so that wouldn't quite do. They wanted to be able to distil the problem down to a few general, provable rules that avoid exact calculations, and that work every time for any circular pizza.

As with many mathematical conundrums, the answer has arrived in stages - each looking at different possible cases of the problem. The easiest example to consider is when at least one cut passes plumb through the centre of the pizza. A quick sketch shows that the pieces then pair up on either side of the cut through the centre, and so can be divided evenly between the two diners, no matter how many cuts there are.

So far so good, but what if none of the cuts passes through the centre? For a pizza cut once, the answer is obvious by inspection: whoever eats the centre eats more. The case of a pizza cut twice, yielding four slices, shows the same result: the person who eats the slice that contains the centre gets the bigger portion. That turns out to be an anomaly to the three general rules that deal with greater numbers of cuts, which would emerge over subsequent years to form the complete pizza theorem.

The first proposes that if you cut a pizza through the chosen point with an even number of cuts more than 2, the pizza will be divided evenly between two diners who each take alternate slices. This side of the problem was first explored in 1967 by one L. J. Upton in *Mathematics Magazine* (vol 40, p 163). Upton didn't bother with two cuts: he asked readers to prove that in the case of four cuts (making eight slices) the diners can share the pizza equally. Next came the general solution for an even number of cuts greater than 4, which first turned up as an answer to Upton's challenge in 1968, with elementary algebraic calculations of the exact area of the different slices revealing that, again, the pizza is always divided equally between the two diners (*Mathematics Magazine*, vol 41, p 46).

With an odd number of cuts, things start to get more complicated. Here the pizza theorem says that if you cut the pizza with 3, 7, 11, 15... cuts, and no cut goes through the centre, then the person who gets the slice that includes the centre of the pizza eats more in total. If you use 5, 9, 13, 17... cuts, the person who gets the centre ends up with less (see diagram).

Rigorously proving this to be true, however, has been a tough nut to crack. So difficult, in fact, that Mabry and Deiermann have only just finalised a proof that covers all possible cases.

Their quest started in 1994, when Deiermann showed Mabry a revised version of the pizza problem, again published in *Mathematics Magazine* (vol 67, p 304). Readers were invited to prove two specific cases of the pizza theorem. First, that if a pizza is cut three times (into six slices), the person who eats the slice containing the pizza's centre eats more. Second, that if the pizza is cut five times (making 10 slices), the opposite is true and the person who eats the centre eats less.

The first statement was posed as a teaser: it had already been proved by the authors. The second statement, however, was preceded by an asterisk - a tiny symbol which, in *Mathematics Magazine*, can mean big trouble. It indicates that the proposers haven't yet proved the proposition themselves. "Perhaps most mathematicians would have thought, 'If those guys can't solve it, I'm not going to look at it.'" Mabry says. "We were stupid enough to look at it."

Most mathematicians would have thought, 'I'm not going to look at it.' We were stupid enough to try Deiermann quickly sketched a solution to the three-cut problem - "one of the most clever things I've ever seen," as Mabry recalls. The pair went on to prove the statement for five cuts - even though new tangles emerged in the process - and then proved that if you cut the pizza seven times, you get the same result as for three cuts: the person who eats the centre of the pizza ends up with more.

Boosted by their success, they thought they might have stumbled across a technique that could prove the entire pizza theorem once and for all. For an odd number of cuts, opposing slices inevitably go to different diners, so an intuitive solution is to simply compare the sizes of opposing slices and figure out who gets more, and by how much, before moving on to the next pair. Working your way around the pizza pan, you tot up the differences and there's your answer.

Simple enough in principle, but it turned out to be horribly difficult in practice to come up with a solution that covered all the possible numbers of odd cuts. Mabry and Deiermann hoped they might be able to deploy a deft geometrical trick to simplify the problem. The key was the area of the rectangular strips lying between each cut and a parallel line passing through the centre of the pizza (see diagram). That's because the difference in area between two opposing slices can be easily expressed in terms of the areas of the rectangular strips defined by the cuts. "The formula for [the area of] strips is easier than for slices," Mabry says. "And the strips give some very nice visual proofs of certain aspects of the problem."

Unfortunately, the solution still included a complicated set of sums of algebraic series involving tricky powers of trigonometric functions. The expression was ugly, and even though Mabry and Deiermann didn't have to calculate the total exactly, they still had to prove it was positive or negative to find out

who gets the bigger portion. It turned out to be a massive hurdle. "It ultimately took 11 years to figure that out," says Mabry.

Over the following years, the pair returned occasionally to the pizza problem, but with only limited success. The breakthrough came in 2006, when Mabry was on a vacation in Kempten im Allgäu in the far south of Germany. "I had a nice hotel room, a nice cool environment, and no computer," he says. "I started thinking about it again, and that's when it all started working." Mabry and Deiermann - who by now was at Southeast Missouri State University in Cape Girardeau - had been using computer programs to test their results, but it wasn't until Mabry put the technology aside that he saw the problem clearly. He managed to refashion the algebra into a manageable, more elegant form.

Back home, he put computer technology to work again. He suspected that someone, somewhere must already have worked out the simple-looking sums at the heart of the new expression, so he trawled the online world for theorems in the vast field of combinatorics - an area of pure mathematics concerned with listing, counting and rearranging - that might provide the key result he was looking for.

Eventually he found what he was after: a 1999 paper that referenced a mathematical statement from 1979. There, Mabry found the tools he and Deiermann needed to show whether the complex algebra of the rectangular strips came out positive or negative. The rest of the proof then fell into place (*American Mathematical Monthly*, vol 116, p 423).

So, with the pizza theorem proved, will all kinds of important practical problems now be easier to deal with? In fact there don't seem to be any such applications - not that Mabry is unduly upset. "It's a funny thing about some mathematicians," he says. "We often don't care if the results have applications because the results are themselves so pretty." Sometimes these solutions to abstract mathematical problems do show their face in unexpected places. For example, a 19th-century mathematical curiosity called the "space-filling curve" - a sort of early fractal curve - recently resurfaced as a model for the shape of the human genome.

Mabry and Deiermann have gone on to examine a host of other pizza-related problems. Who gets more crust, for example, and who will eat the most cheese? And what happens if the pizza is square? Equally appetising to the mathematical mind is the question of what happens if you add extra dimensions to the pizza. A three-dimensional pizza, one might argue, is a calzone - a bread pocket filled with pizza toppings - suggesting a whole host of calzone conjectures, many of which Mabry and Deiermann have already proved. It's a passion that has become increasingly theoretical over the years. So if on your next trip to a pizza joint you see someone scribbling formulae on a napkin, it's probably not Mabry. "This may ruin any pizza endorsements I ever hoped to get," he says, "but I don't eat much American pizza these days."

There are a host of other pizza problems - who gets more crust, for example, and who gets most cheese
Stephen Ornes is a writer based in Nashville, Tennessee

http://www.newscientist.com/article/mg20427381.500-the-perfect-way-to-slice-a-pizza.html?DCMP=NLC-nletter&nsref=mg20427381.500

Stem cells 'to fix cloudy cornea'

Umbilical cord stem cells may help treat people whose vision is damaged by a cloudy cornea, US research suggests.

The cornea is the transparent front part of the eye, which protects the delicate structures underneath and helps focus light.

But disease or injury can make it go cloudy, impairing vision, and corneas for transplant are in short supply.

A US team used human umbilical cord stem cells to treat laboratory mice with abnormally thin, cloudy corneas.

The University of Cincinnati study was presented at an American Society for Cell Biology conference.

" **These findings have the potential to create new and better treatments and an improved quality of life for patients with vision loss due to corneal injury** "
Dr Winston Kao University of Cincinnati

The mice had been bred to lack a protein essential for the formation and maintenance of a transparent cornea.

The cells - known as human umbilical cord mesenchymal stem cells (UMSCs) - have the ability to become any of a wide range of adult cell types.

They survived in the mouse cornea for three months with minimal signs of rejection.

They appeared to take on the properties of standard corneal cells called keratocytes.

Following the transplant, the thickness and transparency of the animals' corneas improved significantly.

In contrast, transplants using a different type of cell - human umbilical hematopoietic stem cells, which can give rise to all blood cell types - produced disappointing results.

They vanished rapidly from the mouse corneas when transplanted into the animals' eyes.

Easy to isolate

Lead researcher Dr Winston Kao said unlike donated corneas, the supply of UMSCs for use in transplants was almost unlimited.

He said the cells were easy to isolate from the umbilical cord, could be grown effectively in culture and stored easily in liquid nitrogen.

Dr Kao said: "Corneal transplantation is currently the only true cure for restoration of eyesight that may have been lost due to corneal scarring caused by infection, mechanical and chemical wounds and congenital defects of genetic mutations.

"Worldwide, there is a shortage of suitable corneas for transplantation.

"These findings have the potential to create new and better treatments and an improved quality of life for patients with vision loss due to corneal injury."

Dr Bruce Allan, a consultant ophthalmic surgeon at London's Moorfields Eye Hospital, said: "Access to cells to build new tissue-engineered corneal constructs may well lead to viable alternatives to conventional transplantation in future.

"The cornea is a relatively simple organ and cell therapies, including those based on mesenchymal stem cells, should ultimately succeed.

"But for the medium term at least, transplantation is likely to continue."

Dr Francisco Arnalich, another expert from Moorfields, has carried out similar work in rabbits using mesenchymal stem cells derived from fat tissue.

He said a US team had also had success using stem cells taken from human corneas.

He said: "There is still a long way to go from saying that they achieved clear corneas - moreover they just state that they improved transparency, not that they reach normal transparency - to say that this could be a substitute of corneal grafting."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8399526.stm

Published: 2009/12/09 00:50:10 GMT

Child cancer heart checks urged

Children who battle and survive cancer run a higher risk of heart problems and must be closely screened, say experts.

Aggressive cancer treatments like chemotherapy and radiotherapy can harm the heart, multiplying the patient's death risk by seven, data shows.

UK guidelines recommend routine heart trace checks every five years.

But many survivors currently receive no follow-up, US doctors, who studied data on 14,000 childhood cancer survivors, say in an article published at bmj.com.

With the number of survivors steadily rising thanks to improved cancer care, health workers need to look out for signs of heart problems in their patients, say the specialist cancer doctors.

Survivors questioned

Most checks have focused on heart damage related to a cancer drug called anthracycline.

But latest work shows that young adult cancer survivors are at risk for a variety of cardiovascular complications, including heart attacks, inflammation of the heart and heart valve abnormalities, as late as 30 years after therapy.

The largest study on the issue yet, which looked at data from more than 14,000 childhood cancer survivors, also shows damage can occur at lower exposures and with more types of cancer treatment than previously appreciated.

Lead researcher Professor Daniel Mulrooney, of the University of Minnesota, said that young adults who survived childhood or adolescent cancer were at risk of serious heart problems not usually recognised within their age group.

"Such individuals require ongoing clinical monitoring, particularly as they approach ages in which cardiovascular disease becomes more prevalent."

Confirming responses

Professor Mike Hawkins, a childhood cancer survival expert from the charity Cancer Research UK, said: "This study is useful in helping healthcare professionals understand the risks of heart disease for those who have had cancer as a child or teenager - and especially which groups will be most at risk."

However, he said that while the research was based on feedback given by survivors who filled in a questionnaire reporting heart disease, the questionnaire responses were not confirmed by doctors.

He said Cancer Research UK was currently confirming all reports of heart disease in this group.

"This will provide valuable information about the best ways to monitor and help young British cancer survivors."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8400925.stm

Published: 2009/12/09 00:32:28 GMT

Battery made of paper charges up

Batteries made from plain copier paper could make for future energy storage that is truly paper thin.

The approach relies on the use of carbon nanotubes - tiny cylinders of carbon - to collect electric charge.

While small-scale nanotube batteries have been demonstrated before, the plain paper approach lends itself to making larger devices more cheaply.

The work, published in Proceedings of the National Academy of Sciences, could lead to "paintable" energy storage.

Because of its structure of millions of tiny, interconnected fibres, paper is a good candidate to hold on to carbon nanotubes, providing a scaffold on which to build devices.

However, paper is also mechanically tough, and can be bent, curled or folded, more than the metal or plastic surfaces that are currently used or under development.

Good on paper

A team of researchers at Stanford University started with off-the-shelf copier paper, painting it with an "ink" made of carbon nanotubes.

The coated paper is then dipped in lithium-containing solutions and an electrolyte to provide the chemical reaction that generates a battery's electric current.

The paper acts to collect the electric charge from the reaction. Using paper in this way could reduce the weight of batteries, typically made with metal current collectors, by 20%.

The team's batteries are also capable of releasing their stored energy quickly. That is a valuable characteristic for applications that need quick bursts of energy, such as electric vehicles - although the team has no immediate plans to develop vehicle batteries.

Liangbing Hu, lead author on the research, said the most important aspect of the demonstration was that paper is an inexpensive and well-understood material - making wider usage of the technology more likely.

"Standard copier paper used in our everyday life can be a solution in storing energy in a more efficient and cheap way," Dr Hu told BBC News.

"The experienced technology developed in the paper industry over a century can be transferred to improve the process and performance of these paper-based devices."

The team says that adaptations to the technique in the future could allow for simply painting the nanotube ink and active materials onto surfaces such as walls.

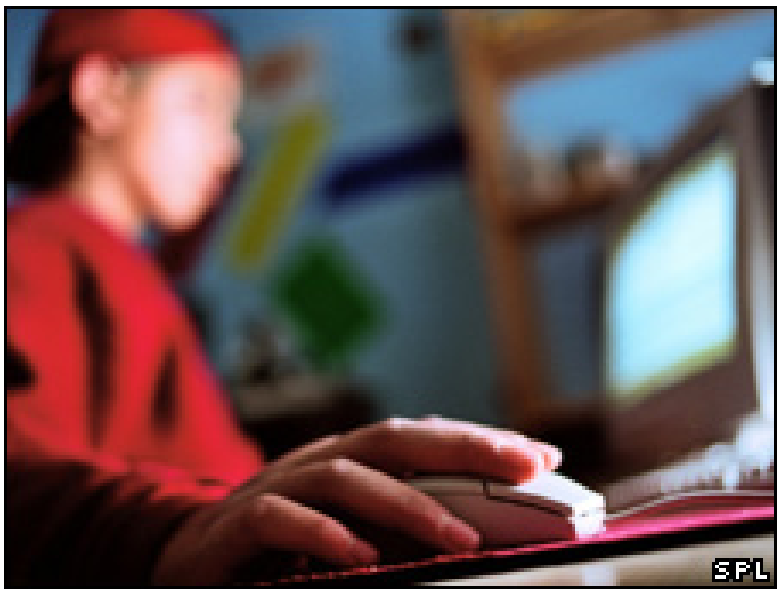
They have even experimented with a number of textiles, paving the way for batteries made largely of cloth.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/technology/8401566.stm

Published: 2009/12/08 16:38:52 GMT

Measures target child web safety
By Jonathan Fildes
Technology reporter, BBC News

Lessons in using the internet safely are set to become a compulsory part of the curriculum for primary schoolchildren in England from 2011.



The lessons are one element of a new government strategy being unveiled called "Click Clever, Click Safe".

Children will also be encouraged to follow an online "Green Cross Code" and block and report inappropriate content.

The measures have been drawn up by the UK Council on Child Internet Safety, a new body comprising 140 organisations.

"We must ensure that this virtual world is safe for our children just as we try to ensure that the real world is," said Prime Minister Gordon Brown at the launch of the campaign.

"The internet is a wonderful and powerful tool that is changing the way we learn and the way we stay in touch," he added, "but unfortunately there are risks from those intent on exploiting its benefits."

The "Zip it, Block it, Flag it" campaign is intended for use by schools, retailers and social networks, although it will be up to individual sites to choose how they use it.

A large scale public information campaign based around the slogan will be mounted from February 2010.

"We hope that 'Zip it, Block it, Flag it' will become as familiar to this generation as 'Stop, Look and Listen' was to the last," said the Prime Minister.

It will encourage children to not give out personal information on the web, block unwanted messages on social networks and report any inappropriate behaviour to the appropriate bodies, which may include the website, teachers or even police.

"The digital code is the green cross code for the digital age," said Dr Tanya Byron, who headed a review into inappropriate material on the internet and in video games.

"Its about what the risks are in the online space," she said. "What can be done in order to help them learn to manage those risks and to get help if they become more than they can sort out themselves."

The Byron review saw the creation of the UK Council for Child Internet Safety (UKCCIS) which has drawn up the digital code.

"No one is saying it is scary stuff," said Dr Byron. "It's about the management of risk in the same way that we want children to understand and manage risk in the real world, in the offline world."

"No-one is saying there are huge massive dangers out there," said Dr Byron.

"18% of children have said they have come across inappropriate material," she said. "Its 18% too many but it's not as big as people believe based on the scare stories and fear-mongering."

Panic button

UKCCIS comprises organisations including Google, Microsoft and Facebook, which have pledged support for the campaign.

A Google spokesman said most of the websites represented by the group already had controls that "help users manage their personal information and block or report unwanted contact".

" **The curriculum is already massively overstretched. It's difficult for teachers to fit everything in** " Anastasia de Waal Civitas

"We're strong supporters of the 'Zip it, Block it, Flag it' educational campaign as another way to get this message out and help young people to remember how to stay safe online."

The 140 organisations are also updating a self-regulatory code of conduct governing online behaviour.

The rules will be published in 2010 and will act as a benchmark against which the government can review websites.

One measure that has been discussed by the group is the use of a "panic button" on social network sites to flag up inappropriate content.

The Child Exploitation and Online Protection (Ceop) centre - the UK law enforcement agency tasked with tracing online sex offenders - already offers a report button for websites.

Clicking the button allows users to contact specially-trained Ceop officers for advice and Ceop says it receives 10,000 hits a month.

It is already used by social network Bebo and MSN Instant Messenger but the government will announce that all 270,000 computers provided under its Home Access scheme will now incorporate the button.

'Isolated cases'

A critical part of the government's plans are educating children about the potential dangers they face online.

Currently only secondary school pupils are taught about internet safety.

Under the new proposals, online safety would be taught to all pupils from the age of five in England as part of their personal, social, health and economic education (PSHE), which includes drug awareness, bullying, sex education, healthy living and personal finance.

WHAT IS PSHE?
- Personal, social, health and economic education
- Topics include: alcohol, drug and tobacco awareness; bullying; sex and relationship education; sexuality; careers advice; personal finance; healthy living; body image and how the body changes; personal well-being
- Taught in age-appropriate ways in both primary and secondary school
- The government wants the subject to be compulsory from 2011

Teaching PSHE is not currently compulsory, but if legislation goes through it will become compulsory in England from 2011.

However, Anastasia de Waal, of think tank Civitas, questioned whether the measures would have much of an impact.

"The curriculum is already massively overstretched," she told BBC News. "It's difficult for teachers to fit everything in."

As a result, she said, teachers would "cover a lot with not much depth".

She said, it would be much better for teachers to talk about everyday situations, including websites, rather than teaching it in isolation.

Social networks and web services are coming under increasing pressure to show that they are doing something to tackle inappropriate content, cyber-bullying and grooming online.

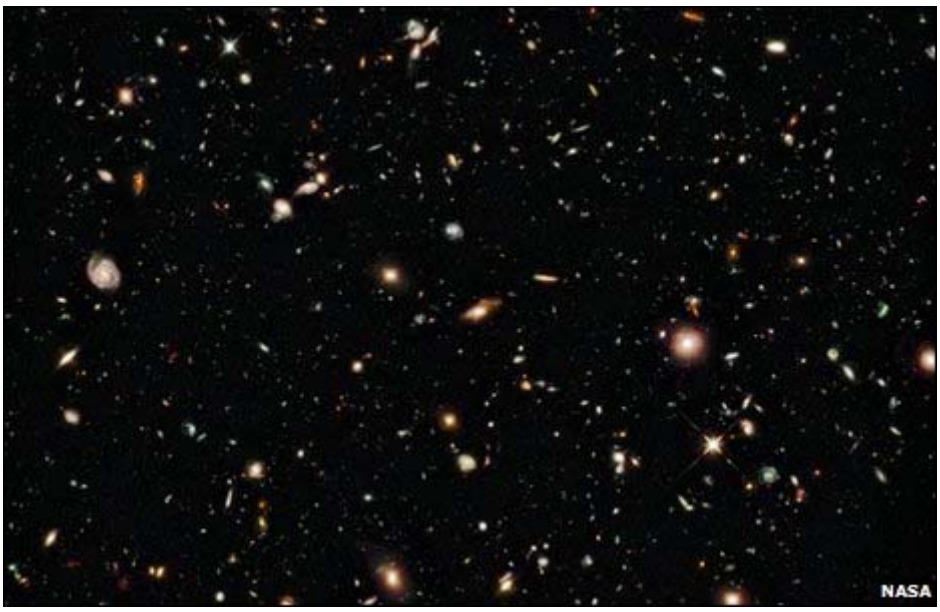
In November, a poll of more than 2,000 young people by charity Beatbullying found that 57% had been harassed online while using Windows Live Messenger.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/technology/8398763.stm

Published: 2009/12/08 16:06:30 GMT

Hubble sees most distant galaxies
By Victoria Gill
Science reporter, BBC News

Nasa's Hubble Space Telescope (HST) has captured its deepest view of the Universe, producing images of galaxies that have never been seen before.



The pictures were acquired by the HST's new Wide Field Camera 3 (WFC3).

This highly sensitive camera can see starlight from far-off objects - light that has been "stretched" by the expanding Universe.

Scientists who have analysed the new images say the galaxies they reveal could be the most distant yet observed.

Two UK-based teams of scientists published their analyses in the Monthly Notices of the Royal Astronomy Society.

WFC3 was added to Hubble as part of a upgrade and repair mission carried out by the space shuttle Atlantis earlier this year.

The camera is sensitive to infrared light, which has wavelengths about twice as long as visible light and cannot be detected by the human eye. It is described as "beyond red".

Dr Andrew Bunker, an astronomer from Oxford University, led one of the teams that studied the new pictures.

He explained that the camera had captured "light that started its life in the visible and has been stretched to longer wavelengths, so it is redder".

Some of the new images are from the region of sky known as the Hubble Ultra Deep Field.

Dr Bunker and his colleagues first analysed this five years ago using Hubble's Advanced Camera for Surveys (ACS).

"We're able to use this new data - taken at long wavelengths - and combine it with the existing data that was taken in the visible [spectrum]," he told BBC News.

"We make a colour image with the long wavelengths and the short wavelengths and look for a very distinctive signature."

That signature is based on colour. The redder an object appears, the more its light has been stretched, and the further away it is.

Looking back

Capturing this stretched starlight gives astronomers a glimpse back in time to the early Universe.

" **These new observations are likely to be the most sensitive images Hubble will ever take** "
Professor Jim Dunlop University of Edinburgh

Dr Daniel Stark, a postdoctoral researcher at the Institute of Astronomy in Cambridge, also worked with the teams reporting their work on Tuesday.

He said: "We can now look even further back in time, identifying galaxies when the Universe was only 5% of its current age - within one billion years of the Big Bang."

But Dr Bunker said that the exact distance to the galaxies was yet to be confirmed.

"The evidence on the basis of the images - the colours - is very strong," he told BBC News.

"These are some of the most distant, and perhaps the most galaxies distant yet seen."

But to confirm this, he said, astronomers would need to study the spectrum of light from each galaxy, to measure its "redshift". This is a measurement of how much the light from a distant object has been stretched.

Professor Jim Dunlop from the University of Edinburgh co-led a team with Dr Ross McLure, which also studied the Hubble data. He said: "These new observations are likely to be the most sensitive images Hubble will ever take."

The follow-up studies, he added, would be possible when Hubble's successor, the James Webb Space Telescope (JWST), was launched in 2014.

Dr Bunker described the JWST as the "next quantum leap in telescope technology".

"It has a greater collecting area and is optimised to work in the infrared," he explained.

"With JWST, we'll be able to take the spectra of many objects at once... This will be wonderful - instead of [analysing] the odd galaxy, we'll be able to build up meaningful samples and do real science."

Record-breaking

In 2007, a group led by Professor Richard Ellis from the California Institute of Technology reported the discovery of light from galaxies at similar, and perhaps even longer, distances than the ones reported on Tuesday.

He and his team employed a technique called gravitational lensing, which uses of the gravity of relatively nearby objects to magnify the light coming from much more distant objects.

Dr Bunker, who has worked with Professor Ellis's team in the past, explained that the scientific community was still actively studying the Caltech team's "very exciting" results.

"The galaxies they looked at were really incredibly faint," he said.

"And they looked at the glow of gas, which is the very limit of what is feasible and difficult for the community to confirm."

He said that he expected Professor Ellis's results eventually to be confirmed and said that all the studies were "complementary".

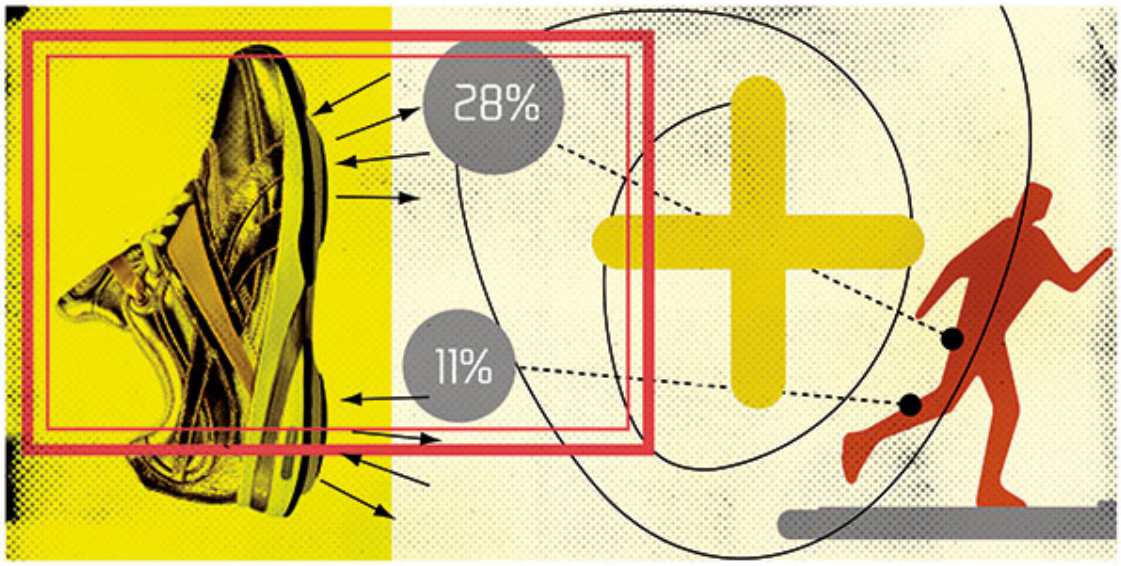
"They show us the different aspects of galaxy formation."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8401374.stm

Published: 2009/12/08 15:46:24 GMT

Firm Body, No Workout Required?

By TARA PARKER-POPE



Can you give your muscles a better workout simply by changing your shoes?

The athletic shoe giant Reebok claims you can. The new EasyTone walking shoe, a provocative new marketing campaign says, leaves leg and buttock muscles better toned than regular walking shoes. Consumers are buying it — literally. Officials from Reebok, a unit of Adidas, say the EasyTone is the company's most successful new product in at least five years.

Other companies have marketed shoes that promise a physiological benefit. Masai Group International, of Switzerland, sells the MBT, a "rocker" shoe with a curved sole, said to ease arthritis and back pain. Shape-Ups from Skechers USA are designed to improve posture and muscle tone and promote weight loss. The FitFlop brand has been engineered to increase leg, calf and gluteal muscle activity, giving the wearer "a workout while you walk."

While most athletic shoes offer support and cushioning, the new muscle-activating shoes are engineered to create a sense of instability. Design elements like curved soles and Reebok's "balance pods" are said to force the wearer to engage stabilizing muscles further, resulting in additional toning for calf, hamstring and gluteal muscles.

That sounds great, but do they really work? To support the claims, the shoemakers each offer company-financed exercise studies suggesting that the shoes produce a higher level of muscle engagement, at least in a controlled research setting.

But the studies don't show whether more engagement leads to meaningful changes in muscle tone or appearance over time. Nor is it clear whether the high level of engagement continues once the walker becomes accustomed to the shoe.

Reebok's EasyTone has made the biggest splash in the muscle-shoe market, especially with its advertising. In one commercial, the camera drifts away from the woman's face and zooms in on her backside. Another advertisement claims that the leg and butt-toning effects of EasyTone will "make your boobs jealous."

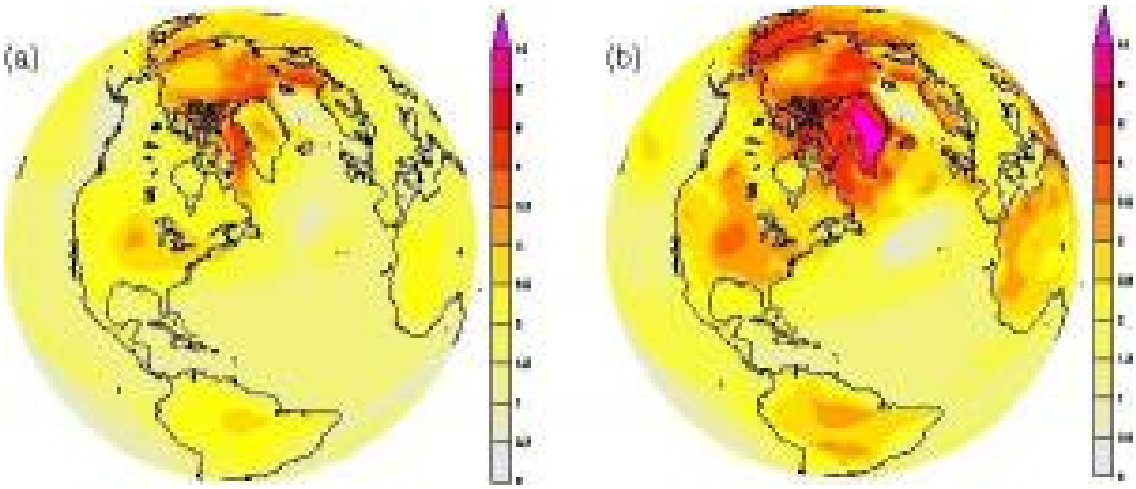
The advertisements, aimed at younger women, have appeared in magazines and online, and a big television campaign is under way: 3,000 commercial slots have been scheduled on network and cable in November and December.

But the claim that the shoes offer muscle toning is backed by a single study involving just five people, not published in a peer-reviewed academic journal. In that study, done at the University of Delaware, five women walked on a treadmill for 500 steps wearing either the EasyTone or another Reebok walking shoe, and while barefoot. Using sensors that measure muscle activity, the researchers showed that wearing the

EasyTone worked gluteal muscles an average of 28 percent more than regular walking shoes. Hamstring and calf muscles worked 11 percent harder.
Reebok's head of advanced innovation, Bill McInnis, said the size of the study was adequate to determine the effect of the shoe and added that exercise studies of this nature commonly used small numbers of participants.
The EasyTone is the brainchild of Mr. McInnis, a former NASA engineer, who said he was interested in the stability balls used in gym workouts and wanted to translate the technology to a shoe. In particular, he was intrigued by the Bosu ball, a small half-sphere that exercisers stand on during workouts as a way to engage leg and core muscles better.
In designing the EasyTone, Mr. McInnis and his team sought to mimic that concept by adding "balance pods" to the toe and heel of the shoe. As the person walks, the air pushes back and forth between toe and heel, and the person sinks into the shoe. The effect is similar to that of walking on a sandy beach — which requires more work, balance and muscle engagement than walking on a flat surface.
John Lynch, head of United States brand marketing for Reebok, said the company's market research showed that four out of five women were especially interested in products that toned their leg and gluteal muscles. Mr. Lynch added that retailers were reporting brisk sales of the shoe; one Los Angeles sporting goods store reported that its Reebok sales more than doubled in November.
Reebok says it has collected 15,000 hours' worth of wear-test data from shoe users who say they notice the difference. "They definitely feel something in their muscles after they've walked in the product," Mr. McInnis said.
One of them is Carol Vanner, 51, an executive assistant in Atlanta who had tried the larger-soled FitFlop shoe and was skeptical she would notice much difference with the EasyTone.
"I thought there was no way they would work, but I tried them and I felt like I had worked out," she said. "Do I look like I'm 20? No, but I feel like when I wear them for periods of time that I have exercised and worked those muscles."
Shay Gipson, 31, an apparel product manager in New York City, said she tried the shoes after hearing a friend rave about them. She immediately felt the balancing effect, she said, and she likes walking in the shoe.
"I can definitely feel the muscle groups in my legs working more than I would in regular shoes," she said. "I feel more toned."
But it remains to be seen whether such effects will make a difference over time. In a July 2008 study of instability boards and balls, Canadian researchers found that among experienced exercisers, moderate instability balls like the Bosu had little effect on muscle activation.
The shoes are designed only for walking, and because of the instability design, wearers are discouraged from running, jumping and engaging in other athletic activities while wearing them. So the real effect may come from simple awareness that they are wearing a muscle-activating shoe, causing them to walk more briskly and with purpose.
"I think buying them with this in mind is likely to increase mindfulness, which is good for health," said Ellen J. Langer, a Harvard psychologist who has studied the connections between mindfulness, exercise and health. "It will probably result in even more walking, with the implicit and explicit virtues endemic to exercise."

http://www.nytimes.com/2009/12/08/health/08well.html?_r=1&nl=health&emc=healthupdateema1

Earth More Sensitive to Carbon Dioxide Than Previously Thought



The temperature response of the Earth (in degrees C) to an increase in atmospheric carbon dioxide from pre-industrial levels (280 parts per million by volume) to higher levels (400 parts per million by volume). (a) shows predicted global temperatures when processes that adjust on relatively short-term timescales (for example sea-ice, clouds, and water vapour) are included in the model (b) includes additional long-tem processes that adjust on relatively long timescales (vegetation and land-ice). (Credit: Image courtesy of University of Bristol)

ScienceDaily (Dec. 7, 2009) — In the long term, the Earth's temperature may be 30-50% more sensitive to atmospheric carbon dioxide than has previously been estimated, reports a new study published in *Nature Geoscience*.

The results show that components of the Earth's climate system that vary over long timescales -- such as land-ice and vegetation -- have an important effect on this temperature sensitivity, but these factors are often neglected in current climate models.

Dan Lunt, from the University of Bristol, and colleagues compared results from a global climate model to temperature reconstructions of the Earth's environment three million years ago when global temperatures and carbon dioxide concentrations were relatively high. The temperature reconstructions were derived using data from three million-year-old sediments on the ocean floor.

Lunt said, "We found that, given the concentrations of carbon dioxide prevailing three million years ago, the model originally predicted a significantly smaller temperature increase than that indicated by the reconstructions. This led us to review what was missing from the model."

The authors demonstrate that the increased temperatures indicated by the reconstructions can be explained if factors that vary over long timescales, such as land-ice and vegetation, are included in the model. This is primarily because changes in vegetation and ice lead to more sunlight being absorbed, which in turn increases warming.

Including these long-term processes in the model resulted in an increased temperature response of the Earth to carbon dioxide, indicating that the Earth's temperature is more sensitive to carbon dioxide than previously recognised. Climate models used by bodies such as the Intergovernmental Panel on Climate Change often do not fully include these long-term processes, thus these models do not entirely represent the sensitivity of the Earth's temperature to carbon dioxide.

Alan Haywood, a co-author on the study from the University of Leeds, said "If we want to avoid dangerous climate change, this high sensitivity of the Earth to carbon dioxide should be taken into

account when defining targets for the long-term stabilisation of atmospheric greenhouse-gas concentrations."

Lunt added: "This study has shown that studying past climates can provide important insights into how the Earth might change in the future."

(a) shows predicted global temperatures when processes that adjust on relatively short-term timescales (for example sea-ice, clouds, and water vapour) are included in the model

(b) includes additional long-tem processes that adjust on relatively long timescales (vegetation and land-ice).

This research was funded by the Research Council UK and the British Antarctic Survey.

Story Source:

Adapted from materials provided by University of Bristol.

Journal Reference:

1. Daniel J. Lunt, Alan M. Haywood, Gavin A. Schmidt, Ulrich Salzmann, Paul J. Valdes and Harry J. Dowsett. **Earth system sensitivity inferred from Pliocene modelling and data**. *Nature Geoscience*, 6 December 2009

http://www.sciencedaily.com/releases/2009/12/091206162955.htm

Better Way for Computers to 'See' Combines Molecular Biology and Gaming Hardware

The DiCarlo Lab (McGovern Institute for Brain Research at MIT) and the Cox Lab (Rowland Institute at Harvard University) have built this 16-GPU 'monster' supercomputer as part of their research efforts to build artificial vision systems inspired by the human brain. The 18" x18" x18" cube may be one of the most compact and inexpensive supercomputers in the world. (Credit: Photo courtesy Nicolas Pinto / MIT)

ScienceDaily (Dec. 7, 2009) — Taking inspiration from genetic screening techniques, researchers from Harvard and MIT have demonstrated a way to build better artificial visual systems with the help of low-cost, high-performance gaming hardware.

The neural processing involved in visually recognizing even the simplest object in a natural environment is profound -- and profoundly difficult to mimic. Neuroscientists have made broad advances in understanding the visual system, but much of the inner workings of biologically-based systems remain a mystery.

Using Graphics Processing Units (GPUs), the same technology video game designers use to render life-like graphics, researchers are now making progress faster than ever before. A new study, co-led by David Cox, Principal Investigator of the Visual Neuroscience Group at the Rowland Institute at Harvard, and Nicolas Pinto, a Ph.D. Candidate in James DiCarlo's laboratory at the McGovern Institute for Brain Research and the Department of Brain and Cognitive Sciences at MIT, was published in the November 26th issue of PLoS Computational Biology.

"Reverse engineering a biological visual system -- a system with hundreds of millions of processing units -- and building an artificial system that works the same way is a daunting task," says Cox. "It is not enough to simply assemble together a huge amount of computing power. We have to figure out how to put all the parts together so that they can do what our brains can do."

"While studying the brain has yielded critical information about how the brain is wired, we currently don't have enough information to build a computer system that works like the brain does," adds Pinto. "Even if we take all of the clues that we have available from experimental neuroscience, there is still an enormous range of possible models for us to explore."

To tackle this problem, the team drew inspiration from screening techniques in molecular biology, where a multitude of candidate organisms or compounds are screened in parallel to find those that have a

particular property of interest. Rather than building a single model and seeing how well it could recognize visual objects, the team constructed thousands of candidate models, and screened for those that performed best on an object recognition task.

The resulting models outperformed a crop of state-of-the-art computer vision systems across a range of test sets, more accurately identifying a range of objects on random natural backgrounds with variation in position, scale, and rotation.

Using ordinary computer processing units, the effort would have required either years of time or millions of dollars of computing hardware. Instead, by harnessing modern graphics hardware, the analysis was done in just one week, and at a small fraction of the cost.

"GPUs are a real game-changer for scientific computing. We made a powerful parallel computing system from cheap, readily available off-the-shelf components, delivering over hundred-fold speed-ups relative to conventional methods," says Pinto. "With this expanded computational power, we can discover new vision models that traditional methods miss."

This high-throughput approach could be applied to other areas of computer vision, such as face identification, object tracking, pedestrian detection for automotive applications, and gesture and action recognition. Moreover, as scientists understand better what components make a good artificial vision system, they can use these hints when studying real brains to understand them better as well.

"Reverse and forward engineering the brain is a virtuous cycle. The more we learn about one, the more we can learn about the other," says Cox. "Tightly coupling experimental neuroscience and computer engineering holds the promise to greatly accelerate both fields."

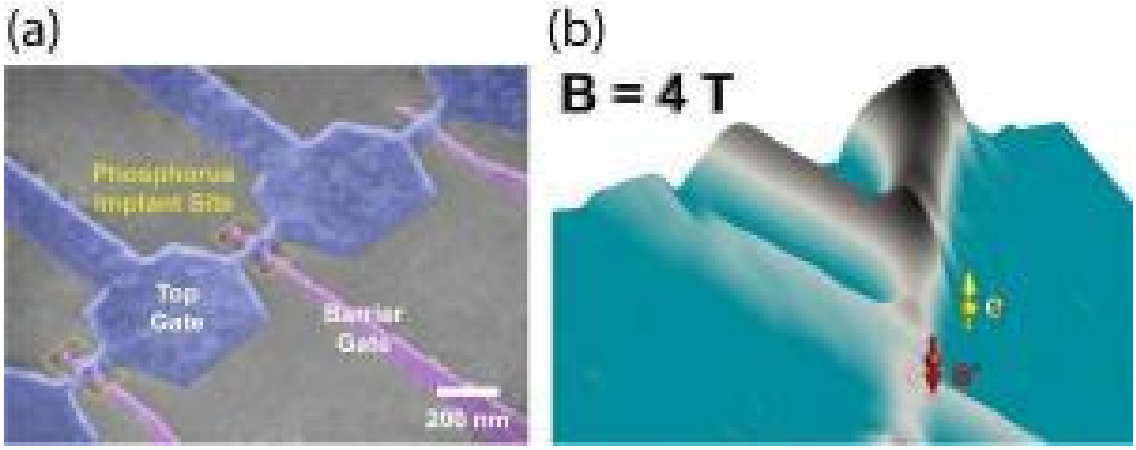
Cox's and Pinto's co-authors included David Doukhan and James J. DiCarlo, both of the McGovern Institute for Brain Science and Department of Brain and Cognitive Sciences at MIT. Hardware for the study was donated by the NVIDIA Corporation.

Story Source:

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

http://www.sciencedaily.com/releases/2009/12/091202172209.htm

Single-Atom Transistor Discovered



(a) Colored scanning electron microscope image of the measured device. Aluminum top gate is used to induce a two-dimensional electron layer at the silicon-silicon oxide interface below the metallization. The barrier gate is partially below the top gate and depletes the electron layer in the vicinity of the phosphorus donors (the red spheres added to the original image). The barrier gate can also be used to control the conductivity of the device. All the barrier gates in the figure form their own individual transistors. (b) Measured differential conductance through the device at 4 Tesla magnetic field. The red and the yellow spheres illustrate the spin-down and -up states of a donor electron which induce the lines of high conductivity clearly visible in the figure. (Credit: American Chemical Society)

ScienceDaily (Dec. 7, 2009) — Researchers from Helsinki University of Technology (Finland), University of New South Wales (Australia), and University of Melbourne (Australia) have succeeded in building a working transistor, whose active region composes only of a single phosphorus atom in silicon.

The results have just been published in *Nano Letters*, a journal of the American Chemical Society.

The working principles of the device are based on sequential tunneling of single electrons between the phosphorus atom and the source and drain leads of the transistor. The tunneling can be suppressed or allowed by controlling the voltage on a nearby metal electrode with a width of a few tens of nanometers.

The rapid development of computers, which created the present information society, has been mainly based on the reduction of the size of transistors. Scientists have known for a long time that this development has to slow down critically during the future decades when the even tighter inexpensive packing of transistors would require them to shrink down to the atomic length scales. In the recently developed transistor, all the electric current passes through the same single atom. This allows researchers to study the effects arising in the extreme limit of the transistor size.

"About half a year ago, I and one of the leaders of this research, Prof. Andrew Dzurak, were asked when we expect a single-atom transistor to be fabricated. We looked at each other, smiled, and said that we have already done that," says Dr. Mikko Möttönen. "In fact, our purpose was not to build the tiniest transistor for a classical computer, but a quantum bit which would be the heart of a quantum computer that is being developed worldwide," he continues.

Problems arising when the size of a transistor is shrunk towards the ultimate limit are due to the emergence of so-called quantum mechanical effects. On one hand, these phenomena are expected to challenge the usual transistor operation. On the other hand, they allow classically irrational behavior which can, in principle, be harnessed for conceptually more efficient computing, quantum computing.

The driving force behind the measurements reported now is the idea to utilize the spin degree of freedom of an electron of the phosphorus donor as a quantum bit, a qubit. The researchers were able to observe in their experiments spin up and down states for a single phosphorus donor for the first time. This is a crucial step towards the control of these states, that is, the realization of a qubit.

Story Source:

Adapted from materials provided by Helsinki University of Technology.

Journal Reference:

1. Kuan Yen Tan, Kok Wai Chan, Mikko Möttönen, Andrea Morello, Changyi Yang, Jessica van Donkelaar, Andrew Alves, Juha-Matti Pirkkalainen, David N. Jamieson, Robert G. Clark, and Andrew S. Dzurak. **Transport Spectroscopy of Single Phosphorus Donors in a Silicon Nanoscale Transistor**. *Nano Letters*, 2009; 091201155150013 DOI: 10.1021/nl901635j

http://www.sciencedaily.com/releases/2009/12/091206085833.htm

Microorganism May Provide Key to Combating Giant Salvinia Throughout Louisiana

Effect of bioherbicide on giant salvinia just ten days after a single treatment was applied. (Credit: Image courtesy of Louisiana Tech University)

ScienceDaily (Dec. 7, 2009) — A team of researchers at Louisiana Tech University has found that a naturally occurring microorganism acts as a natural herbicide against giant salvinia.

Giant salvinia is a noxious and invasive aquatic weed that can block all sunlight penetration into bodies of water, altering entire ecosystems. Under ideal conditions, it's been reported that giant salvinia can double in size every three days.

Dr. H. Lynn Walker, professor of biological sciences at Louisiana Tech, says studies are underway to evaluate the potential for using the microbe as a bioherbicide for control of giant salvinia.

"In view of the preliminary results, we remain optimistic that this research will lead to the development of an additional management tool that can be used to help manage giant salvinia."

Even though the research at Louisiana Tech could have applications for controlling other problematic types of salvinia, Walker says the primary objective is to evaluate the naturally occurring microbe as a potential bioherbicide for control of giant salvinia.

Research results indicate that the microbe can be grown under laboratory conditions and then sprayed onto the foliage of giant salvinia.

"Dr. Walker and his students in the School of Biological Sciences have been very successful in isolating naturally occurring organisms that can be used to control the growth of plant species, including giant salvinia," said Dr. James Liberatos, dean of Louisiana Tech's College of Applied and Natural Sciences.

"As his research progresses, we hope the microorganism can be used successfully to control giant salvinia in places like Lake Bistineau. We have witnessed the devastating environmental effects a rapid growing, invasive plant like giant salvinia can cause. The ability to control its growth with a natural agent is very much needed."

The impact of giant salvinia has not been limited to the waters of north Louisiana. It has had a significant impact the property and safety of residents in low-lying or shoreline areas as well. An unusually wet summer and early fall in north Louisiana has produced flooding and new breeding grounds for giant salvinia.

Preliminary tests show that even one application of the bioherbicide with an adjuvant can drastically reduce the scourge in as few as ten days.

"Dr. Walker has been one of our most prolific inventors," said Dr. Les Guice, Louisiana Tech's vice president for research and development. "This discovery is great evidence of how his innovative research is addressing a major problem in the State but has potential for much broader applications."

Pilot-scale studies are planned at Lake Bistineau to assess the feasibility for development of the microbe as a bioherbicide. These studies will be focused on maximizing herbicidal activity, determination of the long-term effectiveness of treatments, production costs, and integration of the microbe with other control measures.

While the initial results of the research are encouraging, project leaders say the study is still in the early stages of development.

Story Source:

Adapted from materials provided by Louisiana Tech University.

http://www.sciencedaily.com/releases/2009/11/091119193813.htm

Dessert on Your Mind? Your Muscles May Be Getting the Message

Even the anticipation of sweets may cause our muscles to start taking up more blood sugar. (Credit: iStockphoto)

ScienceDaily (Dec. 6, 2009) — Even the anticipation of sweets may cause our muscles to start taking up more blood sugar, say researchers reporting in the December issue of *Cell Metabolism*, a Cell Press publication. That message is delivered via neurons in the brain's hypothalamus containing the chemical known as orexin and the sympathetic nervous system, the studies in mice and rats suggest.

Orexin neurons are known to switch on when we are motivated to eat or seek other rewards. They also play a role in active wakefulness.

"Our results show that good taste, a pleasant meal, and its expectation stimulate muscle glucose utilization and thereby decrease blood glucose level during feeding," said Yasuhiko Minokoshi of the National Institute for Physiological Sciences in Japan. "Thus, blood glucose level after feeding is controlled by hedonic as well as homeostatic regulatory systems."

Minokoshi's team earlier showed that the fat hormone leptin activates glucose uptake and fat burning in muscle. Those effects depend on signals from the hypothalamus, a brain region that is critical for maintaining energy balance.

"However, an important role of the brain is to control the internal environment in our body by responding to and by anticipating external stimuli," Minokoshi said. That led him to suspect that the brain might control glucose metabolism in muscle based on expectations, and orexin seemed a prime candidate to mediate such an effect.

Indeed, Minokoshi and colleague Tetsuya Shiuchi now show that injection of orexin-A into the ventromedial hypothalamus (VMH) of mice or rats increased glucose uptake and storage in skeletal muscle. These effects of orexin were blunted in mice lacking receptors of the sympathetic nervous system.

When mice were conditioned to expect the sweet taste of saccharin, it activated their orexin-MH-sympathetic nervous system to promote insulin-induced glucose uptake, they found. Mice that were allowed to taste and lick a glucose solution for a few consecutive days and were then treated with an orexin-receptor blocker showed higher blood sugar levels than those injected with saline.

"The most important finding is that hedonic feeding affects muscle glucose utilization and that orexin is involved in the regulation," Minokoshi said. Orexin has been shown to stimulate feeding, he added, and in fact, they confirmed that mice lacking the orexin gene were less interested than normal mice in sweets. He concludes that orexin may be responsible for controlling and coordinating both feeding behavior and muscle glucose metabolism.

Minokoshi wonders whether this system may kick in under other conditions as well -- for instance, in athletes before a competition. He says it's an idea his team would like to explore through further studies.

Story Source:

Adapted from materials provided by Cell Press, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2009/12/091201131740.htm

Balancing Protein Intake, Not Cutting Calories, May Be Key to Long Life

Rows of jars containing Drosophila, also known as fruitflies, being bred in laboratory conditions. As Drosophila can be bred easily in mass and have a short lifespan, scientists frequently use them in research, particularly in the study of genes. (Credit: Wellcome Library, London)

ScienceDaily (Dec. 6, 2009) — Getting the correct balance of proteins in our diet may be more important for healthy ageing than reducing calories, new research funded by the Wellcome Trust and Research into Ageing suggests.

The research may help explain why 'dietary restriction' (also known as calorie restriction) -- reducing food intake whilst maintaining sufficient quantities of vitamins, minerals and other important nutrients -- appears to have health benefits. In many organisms, such as the fruit fly (drosophila), mice, rats and the Rhesus monkey, these benefits include living longer. Evidence suggests that dietary restriction can have health benefits for humans, too, though it is unclear whether it can increase longevity.

Dietary restriction can have a potentially negative side effect, however: diminished fertility. For example, the female fruit fly reproduces less frequently on a low calorie diet and its litter size is reduced, though its reproductive span lasts longer. This is believed to be an evolutionary trait: in times of famine, essential nutrients are diverted away from reproduction and towards survival.

To understand whether the health benefits of dietary restriction stem from a reduction in specific nutrients or in calorie intake in general, researchers at the Institute of Healthy Ageing, UCL (University College London), measured the effects of manipulating the diet of female fruit flies. The results of the study are published December 3 in the journal *Nature*.

The fruit flies were fed a diet of yeast, sugar and water, but with differing amounts of key nutrients, such as vitamins, lipids and amino acids. The researchers found that varying the amount of amino acids in the mixture affected lifespan and fertility; varying the amount of the other nutrients had little or no effect.

In fact, when the researchers studied the effect further, they found that levels of a particular amino acid known as methionine were crucial to maximising lifespan without decreasing fertility. Adding methionine to a low calorie diet boosted fertility without reducing lifespan; likewise, reducing methionine content in

a high calorie diet prolonged lifespan. Previous studies have also shown that reducing the intake of methionine in rodents can help extend lifespan.

"By carefully manipulating the balance of amino acids in the diet, we have been able to maximise both lifespan and fertility," explains Dr Matthew Piper, one of the study authors. "This indicates that it is possible to extend lifespan without wholesale dietary restriction and without the unfortunate consequence of lowering reproductive capacity."

Amino acids are the building blocks of life as they form the basis of proteins. Methionine is one of the most important amino acids at it is essential to the formation of all proteins. Whilst proteins are formed naturally in the body, we also consume proteins from many different food types, including meat and dairy products, soy-derived food such as tofu, and pulses. The relative abundance of methionine differs depending on the food type in question; it occurs in naturally high levels in foods such as sesame seeds, Brazil nuts, wheat germ, fish and meats.

"In the past, we have tended to think that the amount of protein is what is important to our diet," says Dr Piper. "We've shown here that in flies -- and this is likely to be the case for other organisms -- the balance of amino acids in the diet can affect health later in life. If this is the case for humans, then the type of protein will be more important.

"It's not as simple as saying 'eat less nuts' or 'eat more nuts' to live longer -- it's about getting the protein balance right, a factor that might be particularly important for high protein diets, such as the Atkins diet or body builders' protein supplements."

Because the effects of dietary restriction on lifespan appears to be evolutionarily conserved -- occurring in organisms from yeast to monkeys -- scientists believe that the mechanisms may also be conserved. This opens up the possibility of using these organisms as models to study how dietary restriction works.

Although the human genome has around four times the number of genes as the fruit fly genome, there is a close relationship between many of these genes. Since it is easy to create mutants and carry out experiments on fruit flies, the functions of many fly genes have been established and newly discovered human genes can often be matched against their fly counterparts. Therefore, even though the fruit fly does not on the surface resemble humans, many findings about its basic biology can be interpreted for human biology.

Story Source:

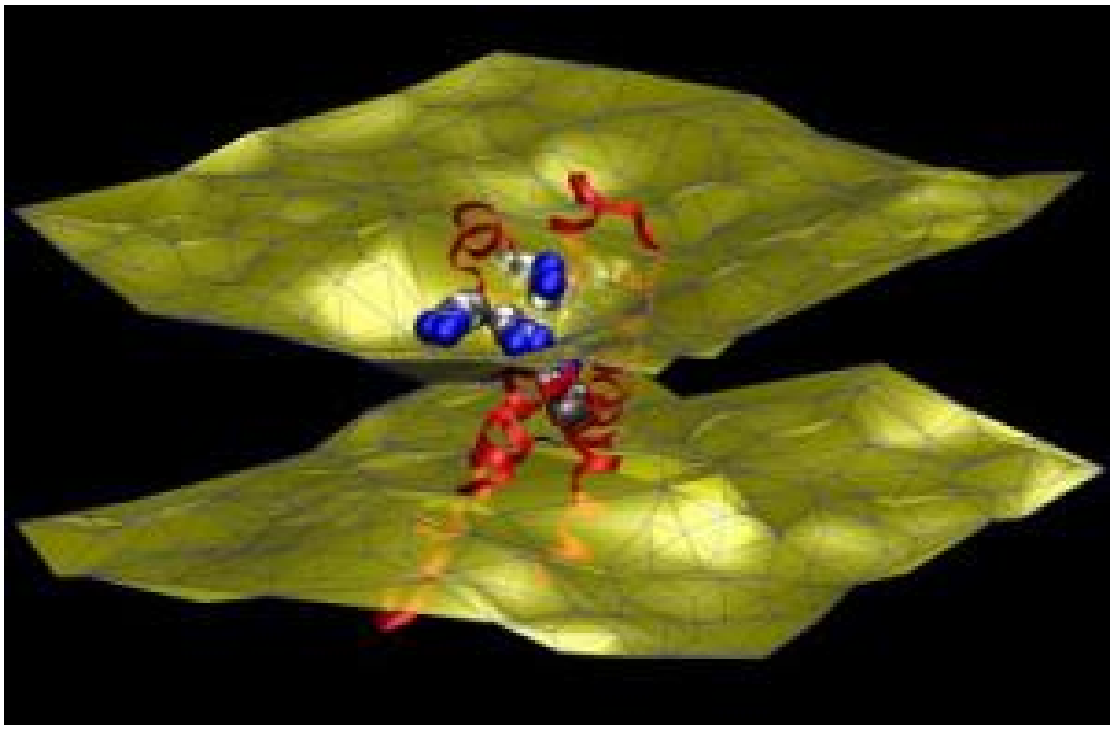
Adapted from materials provided by Wellcome Trust.

Journal References:

1. Grandison et al. **Amino-acid imbalance explains extension of lifespan by dietary restriction in Drosophila**. *Nature*, December 3, 2009; DOI: 10.1038/nature08619

http://www.sciencedaily.com/releases/2009/12/091202131622.htm

Nervy Research: Researchers Take Initial Look at Ion Channels in a Model System



An imaging technique known as neutron diffraction, used along with molecular simulations, revealed that an ion channel's voltage sensing domain (red, yellow and blue molecule at center) perturbs the two-layered cell membrane that surrounds it (yellow surfaces), causing the membrane to thin slightly. (Credit: NIST)

ScienceDaily (Dec. 6, 2009) — Before one of your muscles can twitch, before the thought telling it to flex can race down your nerve, a tiny floodgate of sorts -- called an ion channel -- must open in the surface of each cell in these organs to let in the chemical signals that spur the cell to action. New research at the National Institute of Standards and Technology (NIST) has allowed scientists to observe ion channels within the surface membrane for the first time, potentially offering insights for future drug development.

Because they function as gatekeepers for messages passing among nerve cells, ion channels are the target of a host of drugs that treat psychological and neurological issues. But because the proteins that form the channels are hard to observe, obtaining knowledge of their operation has proved difficult. Studies of the proteins have been limited to either the molecules in isolation or dried and crystallized to get an idea of their structures. Now, a multi-institutional team working at NIST's Center for Neutron Research (NCNR) has provided a glimpse of the proteins in their naturally occurring form and interacting with the surrounding cell membrane.

The findings, just reported in the journal *Nature*, improve our understanding of the moving portion of the ion channel that responds to voltage differences across the cell membrane, according to team leader Stephen White. While the work may not be of practical medical use for some time, he says, it is a useful step toward understanding how signals travel -- particularly among neurons.

"All of the communications in the body are electrical," says White, a biophysicist at the University of California, Irvine. "The motion of life depends on ion channels responding to voltage differences, so that they open and close at just the right moment, controlling the use of energy. Without them, nothing would happen in the body."

By investigating this portion of the ion channel, called a voltage-sensing domain, the team has provided science's first glimpse of how an ion channel's shape and motion affects the cell membrane, which in turn helps protect and stabilize the proteins that form the channel. White says further research could lead to a complete picture of how ion channels function.

"We still can't see in detail how the gate opens and closes, but that's our eventual goal," White says. "We hope that someday we'll be able to detect the motion of these voltage-sensing domains in their up and down states."

The research team, jointly headed by White and Kenton Swartz of the National Institute of Neurological Disorders and Stroke (NINDS), also includes scientists from the University of Missouri, the National Institute of Alcohol Abuse and Alcoholism and the NCNR. Funding for the study was provided by the National Science Foundation, the National Institute of General Medical Sciences and NINDS.

Story Source:

Adapted from materials provided by National Institute of Standards and Technology (NIST).

Journal Reference:

1. D. Krepkiy, M. Mihailescu, J.A. Freites, E.V. Schow, D.L. Worcester, K. Gawrisch, D.J. Tobias, S.H. White and K. Swartz. **Structure and hydration of membranes embedded with voltage-sensing domains**. *Nature*, 2009; 462 (7272): 473 DOI: 10.1038/nature08542

http://www.sciencedaily.com/releases/2009/12/091202091026.htm

Key Seed Size Gene Identified

Scientists have uncovered a gene in plants that is responsible for controlling the size of seeds, which could lead to ways of improving crops to help ensure food security in the future. (Credit: iStockphoto)

ScienceDaily (Dec. 6, 2009) — Scientists from the John Innes Centre in Norwich, UK and the University of Freiburg in Germany have uncovered a gene in plants that is responsible for controlling the size of seeds, which could lead to ways of improving crops to help ensure food security in the future.

Increasing seed or grain size has been key in the domestication of the crops used in modern agriculture, and with a growing world population, further increasing the yield of crops is one goal of agricultural research. Michael Lenhard, funded by the Biotechnology and Biological Sciences Research Council (BBSRC), has identified a gene in the model plant *Arabidopsis* that determines overall seed size, and is now investigating how this could be used to for the improvement of crops.

Publishing in the Proceedings of the National Academy of Sciences, the team from the John Innes Centre, an institute of the BBSRC, demonstrated that the gene acts locally at the base of the growing seed. It produces an as yet unidentified mobile growth signal that determines final seed size. If the gene is turned off, smaller seeds are produced, but crucially if the gene is turned on at a higher level than normal, seeds a third larger in size and weight are produced. This is the first time such a reciprocal effect on seed size has been observed, and points to the fundamental importance of this gene in plant development.

More work is now needed before this research can be applied to crop plants. One effect of increasing the seed size in the experimental plants was to decrease the total number of seeds produced, so there was no overall increase in yield. The scientists did notice an increase in the relative oil content of the larger seeds, so the effects of altering this gene in oil seed rape is currently being investigated.

Unravelling this gene's role in determining the final seed size will also be important for other strategies for increasing yield, an example of how fundamental plant science can inform and drive efforts to ensure food security.

Professor Mike Bevan, Acting Director of the John Innes Centre, said "This work shows how JIC's focus on understanding the mechanisms controlling plant growth can have immediate useful application for crop improvement."

Story Source:

Adapted from materials provided by John Innes Centre.

Journal Reference:

1. Adamski et al. **Local maternal control of seed size by KLUH/CYP78A5-dependent growth signaling**. *Proceedings of the National Academy of Sciences*, 2009; DOI: 10.1073/pnas.0907024106

http://www.sciencedaily.com/releases/2009/11/091111120640.htm

For African Violets, 'Hands Off' Means Healthier

People like to feel the soft, often hairy leaves of African violets, but touching the leaves can cause damage to the plants. (Credit: Photo by Donna Dollins)

ScienceDaily (Dec. 6, 2009) — African violets have a mixed reputation. Their delicate, colorful flowers and furry, soft leaves make them a favorite among home gardeners and growers. But the striking plants are often regarded as temperamental: a precise recipe of light, moisture, warm temperatures, high humidity, and fertilizer is required to encourage african violets to grow and flower.

A recently published study by scientists Julia C. Brotton and Janet C. Cole from the Department of Horticulture and Landscape Architecture at Oklahoma State University (in a recent issue of *HortTechnology*) could provide african violet enthusiasts with important care information about the finicky flower.

Because of their brightly colored flowers and hairy leaves, people are attracted to african violets and often want to touch the leaves and flowers. But how does all this attention affect the plants? The research team set out to determine the effect of "brushing" african violet leaves on plant growth and quality. Cole explained, "Because (african violet) growers work in conditions that can contribute to the development of dry, irritated skin, many growers use body lotions to help soothe and moisturize their dry skin. Many consumers also use these products. Our study researched whether touching or "brushing" african violet leaves causes damage, particularly when body lotion or other skin care products have been applied to hands before touching the plants."

Although previous studies have investigated the effect of various methods of mechanical conditioning, including brushing, on the growth and quality of vegetable and bedding plants, this was the first reported study of the results of plant response to tactile mechanical stress, or "thigmomorphogenesis" on african violets.

Plants of two cultivars of african violet (*Saintpaulia ionantha*), 'Michigan' and 'Gisela', received five brushing treatments during the study: no brushing, brushed for 30 seconds with a latex-gloved hand, brushed for 90 seconds with a latex-gloved hand, brushed for 30 seconds after applying lotion to a nongloved hand, and brushed for 90 seconds with lotion on the nongloved hand.

After five weeks the plants were harvested. At harvest, plants were rated on a scale of 1 to 5 (no damage -- dead/near dead). Plants that were brushed by a gloved hand had lower damage ratings, greater leaf areas,

and greater leaf numbers than plants that were brushed with a nongloved hand to which lotion had been applied. The cultivars varied in their response, with 'Michigan' exhibiting more damage from brushing than 'Gisela'

Summarizing the results, Cole remarked that "the study suggests that repeated brushing reduces plant size and quality of african violets, particularly when done with a bare hand to which lotion has been applied. Brushing leaves of african violets is not recommended because repeated brushing can decrease plant quality and size."

The next time you are tempted to touch that pretty african violet in your kitchen window, remember -- for a healthier plant, keep your hands off!

Story Source:

Adapted from materials provided by American Society for Horticultural Science, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Brotton, Julia C., Cole, Janet C. **Brushing Using a Hand Coated with Body Lotion or in a Latex Glove Decreases African Violet Plant Quality and Size**. *HortTechnology*, 2009; 19: 613-616 [link]

http://www.sciencedaily.com/releases/2009/11/091103171915.htm

Superbright Supernova Is First of Its Kind

In this schematic illustration of the material ejected from SN 2007bi, the radioactive nickel core (white) decays to cobalt, emitting gamma rays and positrons that excite surrounding layers (textured yellow) rich in heavy elements like iron. The outer layers (dark shadow) are lighter elements such as oxygen and carbon, where any helium must reside, which remain unilluminated and do not contribute to the visible spectrum. (Credit: Image courtesy of DOE/Lawrence Berkeley National Laboratory)

ScienceDaily (Dec. 5, 2009) — An extraordinarily bright, extraordinarily long-lasting supernova named SN 2007bi, snagged in a search by a robotic telescope, turns out to be the first example of the kind of stars that first populated the Universe. The superbright supernova occurred in a nearby dwarf galaxy, a kind of galaxy that's common but has been little studied until now, and the unusual supernova could be the first of many such events soon to be discovered.

SN 2007bi was found early in 2007 by the international Nearby Supernova Factory (SNfactory) based at the U.S. Department of Energy's Lawrence Berkeley National Laboratory. The supernova's spectrum was unusual, and astronomers at the University of California at Berkeley subsequently obtained a more detailed spectrum. Over the next year and a half the Berkeley scientists participated in a collaboration led by Avishay Gal-Yam of Israel's Weizmann Institute of Science to collect and analyze much more data as the supernova slowly faded away.

The analysis indicated that the supernova's precursor star could only have been a giant weighing at least 200 times the mass of our Sun and initially containing few elements besides hydrogen and helium -- a star like the very first stars in the early Universe.

"Because the core alone was some 100 solar masses, the long-hypothesized phenomenon called pair instability must have occurred," says astrophysicist Peter Nugent. A member of the SNfactory, Nugent is the co-leader of the Computational Cosmology Center (C3), a collaboration between Berkeley Lab's Physics Division and Computational Research Division (CRD), where Nugent is a staff scientist. "In the extreme heat of the star's interior, energetic gamma rays created pairs of electrons and positrons, which bled off the pressure that sustained the core against collapse."

"SN 2007bi was the explosion of an exceedingly massive star," says Alex Filippenko, a professor in the Astronomy Department at UC Berkeley whose team helped obtain, analyze, and interpret the data. "But instead of turning into a black hole like many other heavyweight stars, its core went through a nuclear runaway that blew it to shreds. This type of behavior was predicted several decades ago by theorists, but never convincingly observed until now."

SN 2007bi is the first confirmed observation of a pair-instability supernova. The researchers describe their results in the 3 December 2009 issue of *Nature*.

On the trail of a strange beast

SN 2007bi was recorded on images taken as part of the Palomar-QUEST Survey, an automated search with the wide-field Oschin Telescope at the California Institute of Technology's Palomar Observatory, and was quickly detected and categorized as an unusual supernova by the SNfactory. The SNfactory has so far discovered nearly a thousand supernovae of all types and amassed thousands of spectra, but has focused on those designated Type Ia, the "standard candles" used to study the expansion history of the Universe. SN 2007bi, however, turned out not to be a Type Ia. For one thing, it was at least ten times as bright.

"The thermonuclear runaway experienced by the core of SN 2007bi is reminiscent of that seen in the explosions of white dwarfs as Type Ia supernovae," says Filippenko, "but on a much larger scale and with a far greater amount of power."

"The discovery is a great example of how we can get all the science, in addition to cosmology, out of the SNfactory search," says Greg Aldering, SNfactory project leader, who was not an author of the *Nature* paper. "Berkeley Lab and Caltech's Astronomy Department agreed that we would split the work, the Lab handling the Type Ia's and Caltech all the other types."

Nugent contacted Gal-Yam, then a Caltech postdoctoral fellow, the lead investigator for the all-other category. "I asked, are you interested? He said, sure!" Nugent then contacted Filippenko, who was about to conduct a night of observation with the 10-meter Keck I telescope on the summit of Mauna Kea in Hawaii. Filippenko immediately set out to obtain an optical spectrum of the unusual supernova.

Caltech researchers subsequently acquired additional spectra with the Keck telescope, as did Paolo Mazzali's team from the Max Planck Institute for Astrophysics in Garching, Germany, using the Very Large Telescope (VLT) in Chile.

Says Mazzali, "The Keck and VLT spectra clearly indicated that an extremely large amount of material was ejected by the explosion, including a record amount of radioactive nickel, which caused the expanding gases to glow very brightly."

Rollin Thomas of CRD, a member of C3 and the SNfactory, aided the early analysis, using the Franklin supercomputer at the National Energy Research Scientific Computing Center (NERSC) to run a code he developed to generate numerous synthetic spectra for comparison with the real spectrum.

"The code uses hundreds of cores to systematically test a large number of simplified model supernovae, searching through the candidates by adjusting parameters until it finds a good fit," says Thomas. "This kind of data-driven approach is key to helping us understand new types of transients for which no reliable theoretical predictions yet exist." The model fit was unambiguous: SN 2007bi was a pair-instability supernova.

"The central part of the huge star had fused to oxygen near the end of its life, and was very hot," Filippenko explains. "Then the most energetic photons of light turned into electron-positron pairs, robbing the core of pressure and causing it to collapse. This led to a nuclear runaway explosion that created a large amount of radioactive nickel, whose decay energized the ejected gas and kept the supernova visible for a long time."

Gal-Yam organized a team of collaborators from many institutions to continue to observe SN 2007bi and obtain data as it slowly faded over a span of 555 days. Says Gal-Yam, "As our follow-up observations started to roll in, I immediately realized this must be something new. And indeed it turned out to be a fantastic example of how we are finding new types of stellar explosions."

Because it had no hydrogen or helium lines, the usual classification scheme would have labeled the supernova a Type Ic. But it was so much brighter than an ordinary Type Ic that it reminded Nugent of

only one prior event, a supernova designated SN 1999as, found by the international Supernova Cosmology Project but unfortunately three weeks after its peak brightness.

Understanding a supernova requires a good record of its rise and fall in brightness, or light curve. Although SN 2007bi was detected more than a week after its peak, Nugent delved into years of data compiled by NERSC from the SNfactory and other surveys. He found that the Catalina Sky Survey had recorded SN 2007bi before its peak brightness and could provide enough data to calculate the duration of the rising curve, an extraordinarily long 70 days -- more evidence for the pair-instability identification.

A fossil laboratory of the early Universe

"It's significant that the first unambiguous example of a pair-instability supernova was found in a dwarf galaxy," says Nugent. "These are incredibly small, very dim galaxies that contain few elements heavier than hydrogen and helium, so they are models of the early Universe."

Dwarf galaxies are ubiquitous but so faint and dim -- "they take only a few pixels on a camera," says Nugent, "and until recently, with the development of wide-field projects like the SNfactory, astronomers had wanted to fill the chip with galaxies" -- that they've rarely been studied. SN 2007bi is expected to focus attention on what Gal-Yam and his collaborators call "fossil laboratories to study the early Universe."

Says Filippenko, "In the future, we might end up detecting the very first generation of stars, early in the history of the Universe, through explosions such as that of SN 2007bi -- long before we have the capability of directly seeing the pre-explosion stars."

With the advent of the multi-institutional Palomar Transient Factory, a fully automated, wide-field survey to find transients, led by Caltech's Shri Kulkarni, and with the aid of the Deep Sky Survey established by Nugent at NERSC to compile historical data from Palomar-QUEST, the SNfactory, the Near Earth Asteroid Team, and other surveys, the collaborators expect they will soon find many more ultrabright, ultramassive supernovae, revealing the role of these supernovae in creating the Universe as we know it today.

The study -- by Avishay Gal-Yam, Paolo Mazzali, Eran Ofek, Peter Nugent, Shrinivas Kulkarni, Mansi Kasliwal, Robert Quimby, Alex Filippenko, Brad Cenko, Ryan Chornock, Roni Waldman, Dan Kasen, Mark Sullivan, Ed Beshore, Andrew Drake, Rollin Thomas, Joshua Bloom, Dovi Poznanski, Adam Miller, Ryan Foley, Jeffrey Silverman, Iair Arcavi, Richard Ellis, and Jin-Song Deng -- appears in the 3 December 2009 issue of *Nature*.

The Berkeley Lab and UC Berkeley contribution to this work was supported by the U.S. Department of Energy's Office of Science, the National Science Foundation, the Gordon and Betty Moore Foundation, the TABASGO Foundation, Gary and Cynthia Bengier, and the Richard and Rhoda Goldman Fund.

Story Source:

Adapted from materials provided by DOE/Lawrence Berkeley National Laboratory.

Journal Reference:

1. Gal-Yam et al. **Supernova 2007bi as a pair-instability explosion**. *Nature*, 2009; 462 (7273): 624 DOI: 10.1038/nature08579

http://www.sciencedaily.com/releases/2009/12/091202153939.htm

Marine Life Collected to Inventory DNA Sequence of All Pacific Island's Living Species

A marble shrimp (Saron marmoratus) found in the coastal waters of Moorea, a Pacific island near Tahiti. UF researchers with the Florida Museum of Natural History are collecting specimens of all the island's marine invertebrate species for DNA sequencing as part of the Moorea Biocode Project. (Credit: Photo courtesy of Gustav Paulay, Florida Museum of Natural History)

ScienceDaily (Dec. 5, 2009) — University of Florida researchers are collecting marine invertebrates on the French Polynesian island of Moorea as part of a massive effort to inventory the DNA sequence of every living species there.

The genetic information collected by scientists from UF's Florida Museum of Natural History is part of a whole-system approach that will be used to study ecological processes in depth across the entire island. Moorea's coral reefs in particular are considered crucial indicators of how natural systems respond to climate change.

"Nobody has ever sequenced a single place to this level," said Gustav Paulay, the project's team leader for marine invertebrates and the Florida Museum's curator of marine malacology. "And nobody has ever investigated coral reef biodiversity this thoroughly in one place."

The three-year Moorea Biocode Project is now in its second year. Several Florida Museum researchers are in the field using scuba gear, snorkels and wading nets to collect specimens for the first-of-its-kind project.

The Florida Museum scientists are one of seven teams collecting specimens on everything from terrestrial vertebrates to algae. Marine invertebrates make up about 50 percent of the species on the island, which is about 37 miles in circumference and 11 miles from Tahiti.

Based at the UC Berkeley Richard B. Gump South Pacific Research Station on Moorea, the UF team collects specimens up to three times a day. The catch includes crabs, shrimp, plankton, mollusks and worms.

Back at the research station lab, the larger specimens are grouped by appearance. The researchers select individual specimens from each grouping to photograph and take tissue samples. The samples are sent to an on-site DNA extractor for immediate preparation, and the DNA is shipped to the Smithsonian Institution for sequencing.

"We can answer all these things in ecology and evolution and resource management if we have a dictionary to the DNA," Paulay said. "We're building that dictionary."

Attempting to collect all species of marine invertebrates is a daunting task. To meet the challenge, Paulay's team divides the works into three sizes: macro (anything longer than four-tenths of an inch), meso (smaller but visible) and micro (less than 1 mm in length).

Paulay hopes to effectively cover the macro fauna, but even that is impossible, he said. Rare things live in strange places. Other things migrate into the area every couple of years. Meso-organisms are even more difficult. Paulay's team uses a number of extractive methods, such as shaking them out of sand and rock, to get as many unique specimens as possible.

Microfauna are the most challenging of all. The coral reefs are full of them, like microscopic plankton in sea water and minute worms in sand and rock. Paulay's team is exploring methods of community DNA extraction. This approach involves running a simultaneous DNA analysis on all organisms found in a sample such as sand. Cluster patterns in the DNA sequences will help indicate individual species. Modern technology can sequence millions of genes at once, making the technique possible.

Larger invertebrates are easier to find, but they still provide plenty of surprises.

"You're always expecting to see things you haven't seen before," Paulay said. "Just about every day there's some really weird thing coming in."

Paulay estimates more than 5 percent of the macrofauna his team collects are new genera and species. The team recently found a new species of crab in deep water that looks like a transition species between a hermit crab and a free-moving crab. It wears a clam shell instead of a snail shell, and its main body has a crab-like triangular shape.

"I knew enough about hermit crabs to know this was pretty special, "Paulay said. "So I e-mailed a picture of it to a specialist and got an answer back the next day."

Having such a vast store of genetic information for Moorea is also bound to attract a lot of additional research, Paulay said. The island's coral reefs are being studied under a long-term ecological research project funded by the National Science Foundation. And DNA information from the Moorea project is being uploaded to a global sequencing effort known as the Barcode of Life, which hopes to collect a DNA sequence for every living thing on the planet.

Story Source:

Adapted from materials provided by University of Florida.

http://www.sciencedaily.com/releases/2009/12/091202153800.htm

'Killer Petunias' Should Join the Ranks of Carnivorous Plants, Scientists Propose

Fading petunias still hold interest for this fly. (Credit: iStockphoto/Denice Breaux)

ScienceDaily (Dec. 5, 2009) — Scientists from the Royal Botanic Gardens, Kew and the Natural History Museum believe that carnivorous behaviour in plants is far more widespread than previously thought, with many commonly grown plants -- such as petunias -- at least part way to being "meat eaters." A review paper, Murderous plants: Victorian Gothic, Darwin and modern insights into vegetable carnivory, is published (4 December 2009) in the *Botanical Journal of the Linnean Society*.

Carnivorous plants have caught the imagination of humans since ancient times, and they fitted well into the Victorian interest in Gothic horrors. Accounts of man-eating plants published in 19th century works have long since been discredited, but they continue to appear in different media including films (Audrey II in Little Shop of Horrors) and books (Tentacula in the Harry Potter series). Even popular Japanese cartoon Pokémon includes some characters based on carnivorous plants (Bellsprout, Weepinbell and Victreebell).

Carnivorous plants fascinated Charles Darwin, and he and his friend Sir Joseph Hooker (Director of the Royal Botanic Gardens, Kew at that time) had an extensive correspondence concerning them. Darwin's book Insectivorous Plants played a critical role in the idea that plants could eat animals being generally accepted. Before this, many botanists (including Linnaeus) had refused to accept that this could be the case.

Since Darwin's time, several groups have been generally recognised as carnivorous plants (including sundews, Venus flytraps and pitcher plants). Various other plants have been suggested as possible carnivores by some authors, but wide acceptance of these has failed to materialise. Defining what constitutes carnivory in plants is a challenge, and authors include or exclude groups of plants on the basis of different sets of criteria. Professor Mark Chase and co-authors from the Royal Botanic Gardens, Kew and the Natural History Museum contend that carnivory and non-carnivory should not be treated as a black and white situation, and they view plants as being on a sliding scale between those that show no carnivorous characteristics and those that are real "meat eaters" such as the Venus flytrap.

Plants like petunias and potatoes have sticky hairs that trap insects, and some species of campion have the common name catchfly for the same reason. However, some of the commonly accepted carnivores have not been demonstrated to have the ability to digest the insects they trap or to absorb the breakdown products. In their paper, Chase et al. review each of the groups of potential carnivores.

Professor Mark Chase, Keeper of the Jodrell Laboratory at the Royal Botanic Gardens, Kew says, "Although a man-eating tree is fictional, many commonly grown plants may turn out to be cryptic carnivores, at least by absorbing through their roots the breakdown products of the animals that they ensnare. We may be surrounded by many more murderous plants than we think."

Vaughan Southgate, President of the Linnean Society of London says, "This scholarly, beautifully illustrated, review of carnivorous plants and the different levels of carnivory that exist in the plant world by botanists at the Royal Botanic Gardens, Kew and the Natural History Museum makes for fascinating reading."

Story Source:

Adapted from materials provided by Wiley-Blackwell, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Mark W. Chase, Maarten J. M. Christenhusz, Dawn Sanders, Michael F. Fay. **Murderous plants: Victorian Gothic, Darwin and modern insights into vegetable carnivory**. *Botanical Journal of the Linnean Society*, 2009; 161 (4): 329 DOI: 10.1111/j.1095-8339.2009.01014.x

http://www.sciencedaily.com/releases/2009/12/091204103747.htm

Popular Herbicide Affects Sexual Development in Frogs, Research Finds

The controversy surrounding the unintended effects of herbicide and pesticide use has intensified as researchers from the University of Ottawa's Department of Biology have identified that atrazine, a heavily-used herbicide, alters the sexual development in frogs. (Credit: iStockphoto/Sven Hoppe)

ScienceDaily (Dec. 5, 2009) — The controversy surrounding the unintended effects of herbicide and pesticide use has intensified as researchers from the University of Ottawa's Department of Biology have identified that atrazine, a heavily-used herbicide, alters the sexual development in frogs.

There have been numerous scientific and journalistic reports on the detrimental effects of herbicides, including atrazine, yet investigations by other research teams report no adverse effects of the popular herbicide.

In an attempt to help resolve differences between the various reports, Dr. Vance Trudeau and his team at the University of Ottawa's Centre for Advanced Research in Environmental Genomics developed a system to evaluate the effects of a commercial formulation of atrazine. Specifically, PhD student Valérie Langlois applied it to outdoor tanks where tadpoles of leopard frogs were kept for an entire spring and summer. Under these semi-natural conditions in mesocosms, the levels of atrazine were low and comparable to those measured in the Canadian environment.

At the end of the summer, the results showed that atrazine levels in the tanks were at levels within currently acceptable guidelines. However, researchers also found that the herbicide reduced the number of tadpoles reaching the froglet stage. Also noteworthy was that atrazine had a feminizing effect on the animal, resulting in sex ratios favouring females, with a reduced number of males.

This study, recently available online in the journal *Environmental Health Perspectives*, raises important questions about the level of atrazine in the environment, and its negative effects on animal development.

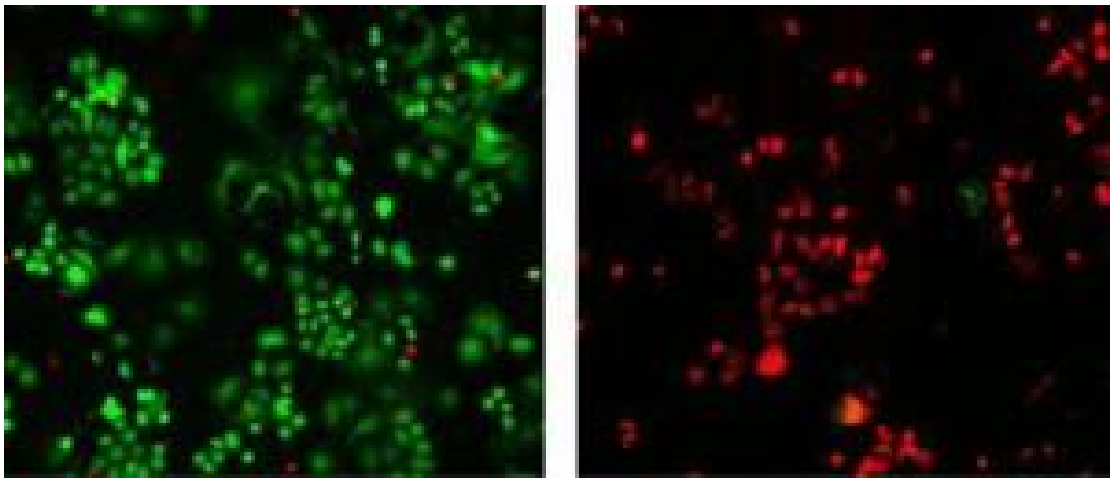
Atrazine is one of the top selling herbicides used worldwide and was designed to inhibit weed growth in cornfields. It is so widely used that it can be detected in many rivers, streams and in some water supplies. This has raised the alarm on the possibility of other serious detrimental environmental effects.

Story Source:

Adapted from materials provided by University of Ottawa.

http://www.sciencedaily.com/releases/2009/12/091203225038.htm

Combining Nanotubes and Antibodies for Breast Cancer 'Search and Destroy' Missions



These photomicrographs demonstrate the dramatic impact of using nanotubes to selectively locate and destroy HER2 breast cancer tumors. Tumor cells on the left were treated only with antibodies against the HER2 protein and then irradiated with near-infrared light. Those on the right were treated with a complex of antibodies and nanotubes and then irradiated. Both cultures then were stained with fluorescent dye -- green color indicates live cells while red marks areas where cell have been killed. (Credit: NIST)

ScienceDaily (Dec. 5, 2009) — Single-walled nanotubes -- cylinders of carbon about a nanometer in diameter -- have been highly touted for potential applications such as ultrastrong fibers, electrical wires in molecular devices, or hydrogen storage components for fuel cells. Thanks to a new development by researchers at the National Institute of Standards and Technology (NIST) and five partners, you can add one more application to the list: detection and destruction of an aggressive form of breast cancer.

HER2 is one of a family of genes that help regulate the growth and proliferation of human cells. Normal cells have two copies of HER2, but about 20 to 25 percent of breast cancer cells have multiple copies of the gene, resulting in the overproduction of a HER2-encoded protein (called HER2 and designated in Roman type versus italics for the gene) that is associated with particularly fast growing and difficult to treat tumors. About 40,000 women in the United States are diagnosed annually with this form of breast cancer.

In a recently published paper in *BMC Cancer*, the NIST-led research team bonded an antibody that has been created to attack the HER2 protein, chicken immunoglobulin Y (IgY), to short nanotubes (about 90 nanometers long, or 5,000 times shorter than an amoeba). Both halves of the special combination -- the antibody and the nanotube -- have critical roles to play in selectively hunting down the HER2 tumor cells and eliminating them.

First, the broad genetic differences between avian and human species means that the chicken IgY antibody to HER2 reacts strongly with the target protein expressed on tumor cells while ignoring normal cells with other human proteins. The carbon nanotubes attached to the antibodies also become linked to the HER2 tumors.

Two unique optical properties of carbon nanotubes allow this link to be exploited for improved detection and destruction of HER2 breast cancer cells. Near-infrared laser light at a wavelength of 785 nanometers reflects intensely off the nanotubes, and this strong signal is easily detected by a technique called Raman spectroscopy. Increase the laser light's wavelength to 808, nanometers and it will be absorbed by the nanotubes, incinerating them and anything to which they're attached -- in this case, the HER2 tumor cells.

The experiment described in the *BMC Cancer* paper was conducted in laboratory cell cultures. Using the HER2 IgY-nanotube complex to selectively identify and target HER2 tumors resulted in a nearly 100 percent eradication of the cancer cells while nearby normal cells remained unharmed. In comparison, there only was a slight reduction in cancer cells for cultures treated with anti-HER2 antibody alone.

The next step for the research team is to conduct mouse trials of the HER2 IgY-nanotube complex to see if the dramatic cancer-killing ability works in animals as well as it does in the lab. In a separate but related project, the team hopes to use a nanotube-antibody combination against another tumor cell protein, MUC4, to treat pancreatic cancer.

The research was funded under an interagency agreement between NIST and the National Cancer Institute (NCI), and in part by a grant from the National Science Foundation. Along with scientists from NIST, the research team included members from Rutgers University, Cornell University, the New Jersey Institute of Technology, NCI and Translabion, a private company located in Clarksburg, Md.

Story Source:

Adapted from materials provided by National Institute of Standards and Technology (NIST).

Journal Reference:

1. Y. Xiao, X. Gao, O. Taratula, S. Treado, A. Urbas, R.D. Holbrook, R.E. Cavicchi, C.T. Avedisian, S. Mitra, R. Savla, P.D. Wagner, S. Srivastava and H. He. **Anti-HER2 IgY antibody-functionalized single-walled carbon nanotubes for detection and selective destruction of breast cancer cells**. *BMC Cancer*, 2009; 9 (1): 351 DOI: 10.1186/1471-2407-9-351

http://www.sciencedaily.com/releases/2009/12/091202091030.htm

Social Scientists Build Case for 'Survival of the Kindest'

Social scientists are amassing a growing body of evidence to show we are evolving to become more compassionate and collaborative in our quest to survive and thrive. (Credit: iStockphoto/Valentin Casarsa)

ScienceDaily (Dec. 9, 2009) — Researchers at the University of California, Berkeley, are challenging long-held beliefs that human beings are wired to be selfish. In a wide range of studies, social scientists are amassing a growing body of evidence to show we are evolving to become more compassionate and collaborative in our quest to survive and thrive.

In contrast to "every man for himself" interpretations of Charles Darwin's theory of evolution by natural selection, Dacher Keltner, a UC Berkeley psychologist and author of "Born to be Good: The Science of a Meaningful Life," and his fellow social scientists are building the case that humans are successful as a species precisely because of our nurturing, altruistic and compassionate traits.

They call it "survival of the kindest."

"Because of our very vulnerable offspring, the fundamental task for human survival and gene replication is to take care of others," said Keltner, co-director of UC Berkeley's Greater Good Science Center. "Human beings have survived as a species because we have evolved the capacities to care for those in need and to cooperate. As Darwin long ago surmised, sympathy is our strongest instinct."

Empathy in our genes

Keltner's team is looking into how the human capacity to care and cooperate is wired into particular regions of the brain and nervous system. One recent study found compelling evidence that many of us are genetically predisposed to be empathetic.

The study, led by UC Berkeley graduate student Laura Saslow and Sarina Rodrigues of Oregon State University, found that people with a particular variation of the oxytocin gene receptor are more adept at reading the emotional state of others, and get less stressed out under tense circumstances.

Informally known as the "cuddle hormone," oxytocin is secreted into the bloodstream and the brain, where it promotes social interaction, nurturing and romantic love, among other functions.

"The tendency to be more empathetic may be influenced by a single gene," Rodrigues said.

The more you give, the more respect you get

While studies show that bonding and making social connections can make for a healthier, more meaningful life, the larger question some UC Berkeley researchers are asking is, "How do these traits ensure our survival and raise our status among our peers?"

One answer, according to UC Berkeley social psychologist and sociologist Robb Willer is that the more generous we are, the more respect and influence we wield. In one recent study, Willer and his team gave participants each a modest amount of cash and directed them to play games of varying complexity that would benefit the "public good." The results, published in the journal American Sociological Review, showed that participants who acted more generously received more gifts, respect and cooperation from their peers and wielded more influence over them.

"The findings suggest that anyone who acts only in his or her narrow self-interest will be shunned, disrespected, even hated," Willer said. "But those who behave generously with others are held in high esteem by their peers and thus rise in status."

"Given how much is to be gained through generosity, social scientists increasingly wonder less why people are ever generous and more why they are ever selfish," he added.

Cultivating the greater good

Such results validate the findings of such "positive psychology" pioneers as Martin Seligman, a professor at the University of Pennsylvania whose research in the early 1990s shifted away from mental illness and dysfunction, delving instead into the mysteries of human resilience and optimism.

While much of the positive psychology being studied around the nation is focused on personal fulfillment and happiness, UC Berkeley researchers have narrowed their investigation into how it contributes to the greater societal good.

One outcome is the campus's Greater Good Science Center, a West Coast magnet for research on gratitude, compassion, altruism, awe and positive parenting, whose benefactors include the Metanexus Institute, Tom and Ruth Ann Hornaday and the Quality of Life Foundation.

Christine Carter, executive director of the Greater Good Science Center, is creator of the "Science for Raising Happy Kids" Web site, whose goal, among other things, is to assist in and promote the rearing of "emotionally literate" children. Carter translates rigorous research into practical parenting advice. She says many parents are turning away from materialistic or competitive activities, and rethinking what will bring their families true happiness and well-being.

"I've found that parents who start consciously cultivating gratitude and generosity in their children quickly see how much happier and more resilient their children become," said Carter, author of "Raising Happiness: 10 Simple Steps for More Joyful Kids and Happier Parents" which will be in bookstores in February 2010. "What is often surprising to parents is how much happier they themselves also become."

The sympathetic touch

As for college-goers, UC Berkeley psychologist Rodolfo Mendoza-Denton has found that cross-racial and cross-ethnic friendships can improve the social and academic experience on campuses. In one set of findings, published in the Journal of Personality and Social Psychology, he found that the cortisol levels of both white and Latino students dropped as they got to know each over a series of one-on-one get-togethers. Cortisol is a hormone triggered by stress and anxiety.

Meanwhile, in their investigation of the neurobiological roots of positive emotions, Keltner and his team are zeroing in on the aforementioned oxytocin as well as the vagus nerve, a uniquely mammalian system that connects to all the body's organs and regulates heart rate and breathing.

Both the vagus nerve and oxytocin play a role in communicating and calming. In one UC Berkeley study, for example, two people separated by a barrier took turns trying to communicate emotions to one another by touching one other through a hole in the barrier. For the most part, participants were able to successfully communicate sympathy, love and gratitude and even assuage major anxiety.

Researchers were able to see from activity in the threat response region of the brain that many of the female participants grew anxious as they waited to be touched. However, as soon as they felt a sympathetic touch, the vagus nerve was activated and oxytocin was released, calming them immediately.

"Sympathy is indeed wired into our brains and bodies; and it spreads from one person to another through touch," Keltner said.

The same goes for smaller mammals. UC Berkeley psychologist Darlene Francis and Michael Meaney, a professor of biological psychiatry and neurology at McGill University, found that rat pups whose mothers licked, groomed and generally nurtured them showed reduced levels of stress hormones, including cortisol, and had generally more robust immune systems.

Overall, these and other findings at UC Berkeley challenge the assumption that nice guys finish last, and instead support the hypothesis that humans, if adequately nurtured and supported, tend to err on the side of compassion.

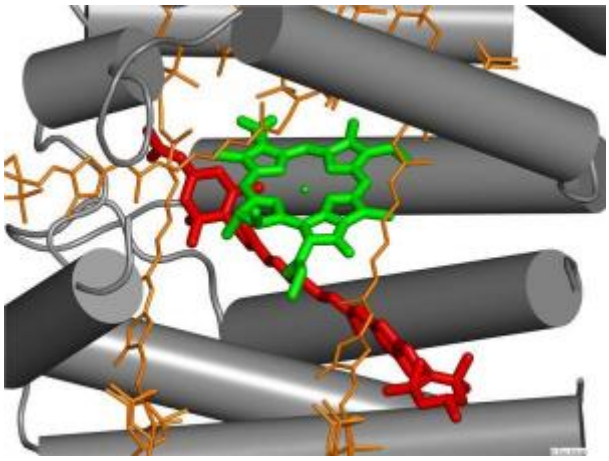
"This new science of altruism and the physiological underpinnings of compassion is finally catching up with Darwin's observations nearly 130 years ago, that sympathy is our strongest instinct," Keltner said.

Story Source:

Adapted from materials provided by University of California, Berkeley. Original article written by Yasmin Anwar, Media Relations.

http://www.sciencedaily.com/releases/2009/12/091208155309.htm

How Dinoflagellates Protect Themselves During Photosynthesis



The pigment molecules in the peridinin-chlorophyll-protein: the central chlorophyll and the identified peridinin are presented as a green and a red sticks, respectively. They are surrounded by further carotinoid molecules (orange) and by the grey-coloured protein. (Credit: Image courtesy of Ruhr-Universitaet-Bochum)

ScienceDaily (Dec. 9, 2009) — During photosynthesis at high light intensities dangerous oxygen radicals can form inside cells. Dinoflagellates have a unique light-harvesting complex (antenna) which can divert superfluous energy extremely efficiently to avoid this cell damage. In cooperation with colleagues in the USA and the Czech Republic, a team of biophysicists from the Ruhr-University Bochum around Prof. Eckhard Hofmann and Tim Schulte has now been able to determine which molecules in the antenna are of significance.

In the complex four carotenoid molecules cluster around a central chlorophyll molecule. The researchers were able to identify one specific carotenoid as a type of integrated lightning rod. It interacts with a "short-living" (nanosecond range, one millionth of a millisecond), energetically activated state of the chlorophyll and diverts the superfluous energy as soon as the chlorophyll passes into a "long-living" (microsecond range, a thousandth of a millisecond) energy state dangerous for the cell.

The scientists have published their findings in the current edition of the *Proceedings of the National Academy of Science (PNAS)*.

During photosynthesis, plants and algae use biophysical and biochemical processes to convert light-energy into chemically stable forms of energy storage. Pigments bound in protein complexes are essential for light-harvesting.

Different pigments absorb different wavelengths of the natural light spectrum, leading to the different colours visible to the human eye.

Plants primarily use green chlorophyll for light absorption, but also contain carotinoids (yellow, orange or red) responsible for the wide spectrum of colouring of autumn foliage, or fruits such as the red tomato. In plants, carotinoids cannot only harvest light, but are also capable of quenching of superfluous light-energy that cannot be used during photosynthesis. They thus primarily have a protective function, preventing the organism from building toxic oxygen radicals when solar radiation is too high.

Dinoflagellates use the carotinoid peridinin as light-harvesting pigment

Dinoflagellates are an important part of marine plankton and live at a depth of about ten metres below sea level. A special attribute of dinoflagellates is that they use a carotinoid, namely peridinin, as light-

harvesting pigment. These algae make use of the fact that peridinin absorbs light of exactly the wavelength that predominates at this specific level below the surface of the sea. The dinoflagellates produce a unique light-harvesting complex, the peridinin-chlorophyll-protein (PCP) for this purpose. This complex consists of one chlorophyll molecule per four peridinin molecules. The peridinins harvest the incoming light and transfer the energy extremely efficiently onto the internal chlorophyll molecule. Presumably the energy is then transferred from this chlorophyll molecule to other light-harvesting proteins and ultimately to the central photosystems where energy transformation and oxygen production take place.

Carotinoid notices excited state of chlorophyll

By targeted modification of the peridinin-chlorophyll-protein, scientists in Bochum -- working at an international level -- have now managed to identify a single peridinin molecule within the peridinin quartet, which interacts more strongly with the central chlorophyll. This peridinin molecule is located so close to the chlorophyll that it is aware of its excited energy state. This proximity also appears to be the prerequisite for preventing the development of a long-living excited state of the chlorophyll. The formation of such a long-living so-called triplet state leads to the development of toxic oxygen radicals that damage the cells.

International cooperation to clarify the relationship between the structure and function

The structural biological research performed in Bochum had to be combined with femtosecond (10 to the power -5 seconds) resolution absorption spectroscopy to be able to investigate this carotinoid-chlorophyll interaction. This was done in Connecticut, USA. Eckhard Hofmann praised this project as an outstanding example of international interdisciplinary cooperation. Based on the results of preparatory research work performed by Roger Hiller and his team from Australia, the biophysicists in Bochum were able to analyze the structure of the proteins investigated. The ultrafast spectroscopic measurements were carried out in extremely close cooperation with Harry Frank and Dariusz Niedzwiedzki's research team in Connecticut. The results were interpreted with the support of Robert Birge (Connecticut) and Tomás Polivka (University of South Bohemia, Czech Republic).

Biophysics and Protein Research Department

The infrastructure for the protein crystallography used in this project was developed by Prof. Eckhard Hofmann during the past few years, originally within the frameworks of the Protein Centre and currently in the Protein Research Department (Contact: Prof. Klaus Gerwert) which is part of the Department of Biophysics, Faculty of Biology and Biotechnology. The work is funded within the collaborative research center SFB480 "Molecular Biology of complex functions in botanical systems" (Contact: Prof. Ulrich Kück).

Story Source:

Adapted from materials provided by Ruhr-Universitaet-Bochum, via AlphaGalileo.

Journal Reference:

1. Tim Schulte, Dariusz M. Niedzwiedzki, Robert R. Birge, Roger G. Hiller, Tomás Polívka, Eckhard Hofmann, and Harry A. Frank. **Identification of a single peridinin sensing Chl-a excitation in reconstituted PCP by crystallography and spectroscopy**. *Proceedings of the National Academy of Sciences*, 2009; DOI: 10.1073/pnas.0908938106

http://www.sciencedaily.com/releases/2009/12/091206185315.htm

Logging Effects Vary Based on a Forest's History, Climate

A trillium blooming. (Credit: iStockphoto/Jon Larson)

ScienceDaily (Dec. 9, 2009) — A Smoky Mountain forest's woodland herb population has shown that climate may play a role in how forest understories recover from logging, according to Purdue University research.

Despite heavy logging in portions of the forest nearly 80 years ago, the distribution of trillium plants on the secondary forest floor was similar to that of undisturbed areas. Michael Jenkins, a Purdue assistant professor of forestry and natural resources, said that contrasts with a study by other researchers of an Oregon forest in which trillium didn't recover after logging.

Jenkins said the findings, reported in a November issue of the journal *Forest Ecology and Management*, suggest that climate and history play a role in a forest's ability to rebound from logging. The study was done in collaboration with Christopher R. Webster, an associate professor of forest resources at Michigan Technological University.

"There's still a lot of controversy about the effects of logging," Jenkins said. "There is an effect on a forest, but there is also recovery as we've seen."

The Smoky Mountain site receives 51.3 centimeters of rain in the summer months, compared to an Oregon site -- which received 7.3 centimeters of rain -- in which trillium did not rebound well after logging. Also, the Oregon site was burned and replanted after it was logged. The Smoky Mountain site was not treated post-logging.

Trillium is a woodland herb that spreads slowly, often with ants moving its seeds only a meter at a time. The slow spread makes trillium a model plant to show the effect that a major disturbance such as logging has on a forest's understory. Trillium plants also can live for more than 20 years, and stem scars act much in the way rings do in tree trunks to allow for determining the plant's age.

"The old-growth trillium populations were structurally complex, but the secondary-growth populations were nearly as complex," Jenkins said. "It suggests that the population in secondary forests was not eliminated by historic logging. Populations of secondary-forest trillium are quite healthy and still expanding. They've had sufficient time to develop more complex clusters of individual plants."

"We would expect that you'd see similar trends in other understory species, but they're difficult to study because you don't have the ability to age the plants the same way you can trillium," Jenkins said.

Jenkins' future research will focus on whether logged and unlogged areas differ in how often populations of trillium occur across large forest areas to confirm this study's findings on a larger scale.

Story Source:

Adapted from materials provided by Purdue University. Original article written by Brian Wallheimer.

Journal Reference:

1. Jenkins et al. **Spatial patterning and population structure of a common woodland herb, Trillium erectum, in primary and post-logging secondary forests**. *Forest Ecology and Management*, 2009; 258 (11): 2569 DOI: 10.1016/j.foreco.2009.09.013

http://www.sciencedaily.com/releases/2009/12/091202114046.htm

Brightness Variations of Sun-Like Stars: The Mystery Deepens

Born from clouds of gas and dust, stars like our Sun spend most of their lifetime slowly burning their primary nuclear fuel, hydrogen, into the heavier element helium. After leading this bright and shiny life for several billion years, their fuel is almost exhausted and they start swelling, pushing the outer layers away from what has turned into a small and very hot core. These "middle-aged" stars become enormous, hence cool and red — red giants. All red giants exhibit a slow oscillation in brightness due their rhythmic "breathing" in and out, and one third of them are also affected by additional, slower and mysterious changes in their luminosity. After this rapid and tumultuous phase of their later life, these stars do not end in dramatic explosions, but die peacefully as planetary nebulae, blowing out everything but a tiny remnant, known as white dwarf. (Credit: ESO/S. Steinhöfel)

ScienceDaily (Dec. 9, 2009) — An extensive study made with ESO's Very Large Telescope deepens a long-standing mystery in the study of stars similar to the Sun. Unusual year-long variations in the brightness of about one third of all Sun-like stars during the latter stages of their lives still remain unexplained. Over the past few decades, astronomers have offered many possible explanations, but the new, painstaking observations contradict them all and only deepen the mystery. The search for a suitable interpretation is on.

"Astronomers are left in the dark, and for once, we do not enjoy it," says Christine Nicholls from Mount Stromlo Observatory, Australia, lead author of a paper reporting the study. "We have obtained the most comprehensive set of observations to date for this class of Sun-like stars, and they clearly show that all the possible explanations for their unusual behaviour just fail."

The mystery investigated by the team dates back to the 1930s and affects about a third of Sun-like stars in our Milky Way and other galaxies. All stars with masses similar to our Sun become, towards the end of their lives, red, cool and extremely large, just before retiring as white dwarfs. Also known as red giants, these elderly stars exhibit very strong periodic variations in their luminosity over timescales up to a couple of years.

"Such variations are thought to be caused by what we call 'stellar pulsations'," says Nicholls. "Roughly speaking, the giant star swells and shrinks, becoming brighter and dimmer in a regular pattern. However, one third of these stars show an unexplained additional periodic variation, on even longer timescales -- up to five years."

In order to find out the origin of this secondary feature, the astronomers monitored 58 stars in our galactic neighbour, the Large Magellanic Cloud, over two and a half years. They acquired spectra using the high resolution FLAMES/GIRAFFE spectrograph on ESO's Very Large Telescope and combined them with images from other telescopes [1], achieving an impressive collection of the properties of these variable stars.

Outstanding sets of data like the one collected by Nicholls and her colleagues often offer guidance on how to solve a cosmic puzzle by narrowing down the plethora of possible explanations proposed by the theoreticians. In this case, however, the observations are incompatible with all the previously conceived models and re-open an issue that has been thoroughly debated. Thanks to this study, astronomers are now aware of their own "ignorance" -- a genuine driver of the knowledge-seeking process, as the ancient Greek philosopher Socrates is said to have taught.

"The newly gathered data show that pulsations are an extremely unlikely explanation for the additional variation," says team leader Peter Wood. "Another possible mechanism for producing luminosity variations in a star is to have the star itself move in a binary system. However, our observations are strongly incompatible with this hypothesis too."

The team found from further analysis that whatever the cause of these unexplained variations is, it also causes the giant stars to eject mass either in clumps or as an expanding disc. "A Sherlock Holmes is needed to solve this very frustrating mystery," concludes Nicholls.

Note

[1] Precise brightness measurements were made by the MACHO and OGLE collaborations, running on telescopes in Australia and Chile, respectively. The OGLE observations were made at the same time as the VLT observations.

This research was presented in two papers: one appeared in the November issue of the *Monthly Notices of the Royal Astronomical Society* ("Long Secondary Periods in Variable Red Giants", by C. P. Nicholls et al.), and the other has just been published in the *Astrophysical Journal* ("Evidence for mass ejection associated with long secondary periods in red giants", by P. R. Wood and C. P. Nicholls).

The team is composed of Christine P. Nicholls and Peter R. Wood (Research School of Astronomy and Astrophysics, Australia National University), Maria-Rosa L. Cioni (Centre for Astrophysics Research, University of Hertfordshire, UK) and Igor Soszyński (Warsaw University Observatory).

Story Source:

Adapted from materials provided by European Southern Observatory - ESO.

http://www.sciencedaily.com/releases/2009/12/091207150440.htm

Deep Space Maintenance Deep in Australia's Bush

ESA's first 35m deep-space station at New Norcia, Australia. (Credit: Image courtesy of European Space Agency)

ScienceDaily (Dec. 9, 2009) — This month, a team of ESA experts together with industrial partners has deployed to the hot outback of New Norcia, Australia, location of the Agency's first 35m deep-space station, DSA-1. The team will undertake an intensive, 12-day programme of repairs and upgrades, enhancing technical reliability and boosting the station's capability to track and communicate with sophisticated missions orbiting Earth, Mars and Venus.

The giant 35-metre station was taken off-line on 30 November, after lengthy preparations and rescheduling with other ESTRACK stations to support New Norcia's communications workload. In recent months, the station has been assigned telecommand upload and data download tasks for Cluster, Mars Express, Rosetta, Venus Express and XMM-Newton.

The Agency's core ESTRACK network comprises 13 terminals sited at nine stations in six countries.

"We initially requested 14 days of off-line time for our upgrade work, but all we could get was 12 days due to the high demand. This means we will work extended hours here at New Norcia to finish on time," said Friedrich Müller-Stute, project officer from ESOC, ESA's European Space Operations Centre, Darmstadt, Germany.

Improving station reliability and performance

The work will primarily focus on improving the reliability of the station's cooling systems, which moderate the temperature of the two 20-kilowatt high-power amplifiers that are used to boost the strength of signals sent to spacecraft orbiting millions of kilometres away.

In addition to several other repair and upgrade tasks, work will be done to improve the performance of the mechanical systems that enable the giant 35m dish antenna to rotate and elevate. New Norcia station was built in 2002 and could initially provide a highly accurate rotation and elevation capability of 0.4 degrees/second -- so it would make a complete revolution in about 15 minutes.

"The original rotation speed is proving to be too slow, and it is taking too long to rotate to a new pointing position or to 'unwind' back into the starting position. So we will boost the rotation and elevation speed to one degree per second, which will really help," says ESOC's Udo Kugel, one of the project engineers.

New Norcia's mechanical movable structure weighs 580 tonnes, and the antenna and associated terminal equipment comprise one world's largest devices for telemetry, tracking and telecommand (TT&C) applications.

Intensive work deep in the Australian bush

The extended team on site for the project includes engineers from ESA, contractor engineers and technicians from industrial partners in Germany, Canada and Australia, and engineers and support personnel from the station's operators, Stratos, who manage the New Norcia and Perth ESTRACK stations on behalf of ESA.

The long hours required by the ESA project fit right in with the famous 'can-do' approach of Western Australia's hard-working rural population.

ESA and contractor team are 'right at home'

"We already feel right at home with locals. The head of the district volunteer fire brigade gave us a very nice welcome, and thanked us for the water trailer that was furnished by ESA last year to support their efforts at protecting the station and its surroundings. They made good use of it fighting bush fires last week," said Müller-Stute.

In a telephone call on 30 November from New Norcia, the ESA engineering team reported clear, dry spring conditions with the temperature at a very hot 35C, forecast to rise sharply at week's end.

"The summertime temperatures can easily hit 40C, and it is surprising to see how much this can affect the equipment on site." Conditions at the station, which is unmanned (and auto-controlled from ESOC, in Germany) during routine operations, are austere; in addition to the giant terminal and its base structure, there are just the minimum number of support buildings, including an on-site power station, a control room and several storage and site maintenance sheds.

The site is 130 km North of Perth and approximately 30 minutes by road to the nearest town.

Despite the threat of fire, the location is ideal for tracking spacecraft. It is far from interference from any urban population, the climate is dry and the site is elevated approximately 250 m above sea level; the skies are clear for much of the year.

"Our regular maintenance has to address the strong effects of heat and sunlight, which degrade cables, cable fasteners, pipes and anything made of plastic. The summertime temperatures can easily hit 40C, and it is surprising to see how much this can affect the equipment on site," said ESA's Michel Dugast, project leader and also based at ESOC.

Dugast adds that: "Supporting our science, astronomy and other important missions means that there are very high technical expectations for New Norcia and all the ESTRACK stations. Our planning for New Norcia allows for just 5 hours per year of unplanned off-line time per year. This station really has to perform -- and upgrades like these are crucial for ensuring success."

Story Source:

Adapted from materials provided by European Space Agency.

http://www.sciencedaily.com/releases/2009/12/091206185115.htm

Milling and Drilling in Cyberspace

Trainees use a computer to operate this virtual handling system for biological compounds. They can transport Petri dishes with bacteria cultures over a conveyor, control grippers and take samples. (Credit: Copyright Fraunhofer IFF)

ScienceDaily (Dec. 9, 2009) — Machinists, numerical control programmers or mechatronics engineers -- trainees in engineering jobs often have to master complex equipment. In the future, trainees will practice and learn milling, turning, drilling and programming routines son a virtual model.

A trainee carefully clamps a workpiece in a lathe. He must program the machine correctly before he can machine the part. This is a tricky task and the trainee will have to solve a similar problem for his final exam. Therefore, he is learning to handle such equipment at a vocational school. However, rather than standing in front of a real machine, he sits in front of a computer. The control panels and the lathe behind it appear on a monitor. A computer guides the trainee step by step.

The Fraunhofer Institute for Factory Operation and Automation IFF, the Technologie- und Berufsbildungszentrum TBZ Magdeburg and the Schweisstechnische Lehr- und Versuchsanstalt SLV Halle have launched the ViReKon project, which is being coordinated by the Rationalisierungs- und Innovationszentrums RKW Sachsen-Anhalt. They intend to train engineers with the aid of virtual reality VR. Researchers at the Fraunhofer IFF are developing virtual models of different machines for this.

"The TBZ presently uses a simple model of a real sorting system for hands-on training. It only allows trainees to practice a few tasks though," says André Winge, Group Manager at the Fraunhofer IFF. "However, budding mechatronics engineers, programmers or machinists can be taught quite specifically on virtual equipment and train a whole number of different tasks."

To this end, the experts from the Fraunhofer IFF are developing special e-learning methods together with the vocational trainers. "A trainee ought to be able to operate more than just the machine and the control unit," says Winge. "An integrated didactic training concept explains the tasks to students. The system monitors their achievement and provides them feedback on the correctness of their performance of the individual tasks."

Another advantage: Vocational schools do not have to purchase any expensive equipment. Turning, drilling and milling are possible in cyberspace -- on large as well as small machines.

"We are able to design a virtual model of any system," says Winge.

For instance, the researchers also created a VR model of a handling system for biological compounds. A conveyor transports Petri dishes with bacteria cultures. A gripper picks them up and transfers them to the sampling station where a pipetting unit takes a sample and processes it further. Trainees follow the procedure in the virtual system on a monitor, while the control unit they use is real. Specialists or maintenance engineers in companies could also be trained on such a VR system in the future.

Story Source:

Adapted from materials provided by Fraunhofer-Gesellschaft.

http://www.sciencedaily.com/releases/2009/12/091207123753.htm

Maize Was Passed from Group to Group of Southwestern Hunter-Gatherers, Study Suggests

New research suggests that maize was passed from group to group of Southwestern hunter-gatherers. (Credit: iStockphoto)

ScienceDaily (Dec. 8, 2009) — An international group of anthropologists offers a new theory about the diffusion of maize to the Southwestern United States and the impact it had.

Published the week of Dec. 7 in the *Proceedings of the National Academy of Sciences*, the study, co-authored by Gayle Fritz, Ph.D., professor of anthropology in Arts & Sciences at Washington University in St. Louis, and colleagues, suggests that maize was passed from group to group of Southwestern hunter-gatherers.

These people took advantage of improved moisture conditions by integrating a storable and potentially high-yielding crop into their broad-spectrum subsistence strategy.

"For decades, there have been two competing scenarios for the spread of maize and other crops into what is now the U.S. Southwest," Fritz said.

According to the first, groups of farmers migrated northward from central Mexico into northwest Mexico and from there into the Southwest, bringing their crops and associated lifeways with them.

In the second scenario, maize moved northward from central Mexico to be Southwest by being passed from one hunter-gatherer band to the next, who incorporated the crop into their subsistence economies and eventually became farmers themselves.

"The case for long-distance northward migration of Mexican farming societies received a boost about 12 years ago when British archaeologist Peter Bellwood, joined a few years later by geographer Jared Diamond and linguist Jane Hill, included the Southwest in a grand global model in which long-distance migration of agriculturalists explains the spread of many of the world's major language families," Fritz said. "In the Southwest case, Uto-Aztecan-speaking peoples, ancestors of people who speak modern languages, like Comanche and Hopi, would have been responsible for the diffusion."

In this paper, the researchers summarize the most recent archaeological evidence, and integrate what is currently known about early maize in the Southwest with genetic, paleoecological, and historical linguistic studies.

Corn from five sites in Arizona and New Mexico now predates 2,000 B.C., which makes it too early to be explained by diffusion of settled Mexican villagers, said Fritz.

"No artifacts or features of any type point to in-migrating Mesoamerican farmers; in fact, continuity of local traditions is manifested, with independent invention of low-fired ceramics and with the construction of irrigation features in the Tucson Basin dating earlier than any known south of the border," she said. "We interpret the linguistic evidence as favoring a very early (beginning shortly after 7,000 B.C.), north-to-south movement of Proto-Uto-Aztecan hunter-gatherers and subsequent division into northern and southern Uto-Aztecan-speaking groups. "

These two groups do not share words and meanings for maize because, according to the researchers' scenario, farming post-dates their separation.

"We think the Southwest stands as a region in which indigenous foragers adopted crops and made the transition to agriculture locally rather than having been joined or displaced by in-migrating farming societies," Fritz said. "Peter Bellwood may well be correct that long-distance movements account for some examples of the expansion of languages and farming technologies, but cases like that of the Southwest are very important in demonstrating that this pattern did not apply universally."

Lead authors of this study are William L. Merrill of the National Museum of Natural History and Robert J. Hard of University of Texas at San Antonio. Co-authors are Fritz, Karen R. Adams of Crow Canyon Archaeological Center, John R. Roney of Colinas Cultural Resource Consulting and A.C. MacWilliams of University of Calgary.

Full text of the study is available at http://www.pnas.org/content/early/2009/12/03/0906075106

Story Source:

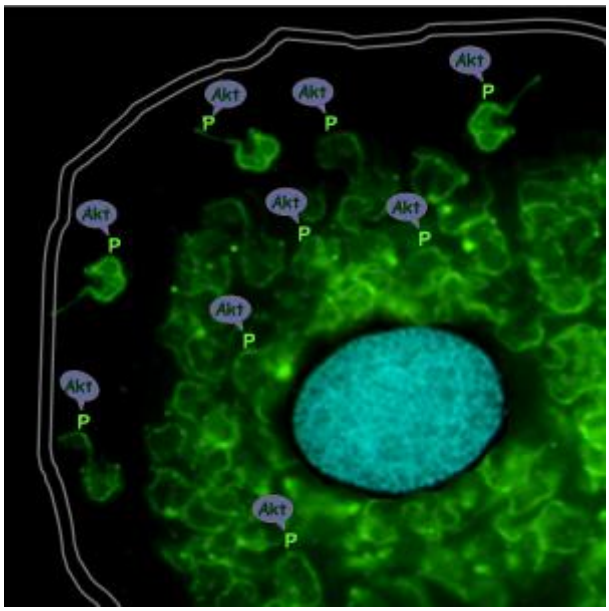
Adapted from materials provided by Washington University in St. Louis.

Journal Reference:

1. William L. Merrill, Robert J. Hard, Jonathan B. Mabry, Gayle J. Fritz, Karen R. Adams, John R. Roney, and A. C. MacWilliams. **The diffusion of maize to the southwestern United States and its impact**. *Proceedings of the National Academy of Sciences*, 2009; DOI: 10.1073/pnas.0906075106

http://www.sciencedaily.com/releases/2009/12/091208162656.htm

Parasite Evades Death by Promoting Host Cell Survival



A human cell infected with Trypanosoma cruzi. Akt kinase (shown in purple) activates PDNF (shown in green) on the parasite surface. (Credit: Image courtesy of Tufts University, Health Sciences)

ScienceDaily (Dec. 8, 2009) — The parasite *Trypanosoma cruzi* (or *T. cruzi*), which causes Chagas' disease, will go to great lengths to evade death once it has infected human host cells, researchers have discovered. In a study published in the November 17 online issue of *Science Signaling*, the researchers describe how a protein called parasite-derived neurotrophic factor (PDNF) prolongs the life of the *T. cruzi* parasite by activating anti-apoptotic (or anti-cell-death) molecules in the host cell. These protective mechanisms help to explain how host cells continue to survive despite being exploited by *T. cruzi* parasites.

"We asked ourselves, 'How is it possible that the host cells stay alive for so long with thousands of *T. cruzi* parasites consuming the host cell's vital resources?' We discovered that PDNF on the surface of the *T. cruzi* parasite essentially inhibits cell death signals and activates cell-protective mechanisms, ensuring *T. cruzi* sufficient time to develop and reproduce in the host cell," says senior author Mercio Perrin, MD, PhD, professor in the pathology department at Tufts University School of Medicine (TUSM) and member of the immunology program faculty at the Sackler School of Graduate Biomedical Sciences at Tufts.

Taking a multi-faceted approach, the researchers used bioinformatics, immunochemistry, intracellular colocalization microscopy, and in vitro enzymatic techniques to study *T. cruzi*'s survival in the host. Perrin and co-author Marina Chuenkova, PhD, a research instructor in the pathology department at TUSM and the Sackler School, demonstrated that PDNF is a substrate and activator of Akt kinase, an enzyme that promotes cell survival by inhibiting "cell death" proteins.

"Further investigation showed that within *T. cruzi*-infected cells, PDNF also activates increased production of Akt, prolonging its protective effects," says Chuenkova. "Akt is a key regulator of diverse cellular processes, and supports cell survival not only by inhibiting apoptotic molecules, but additionally by increasing nutrient uptake and metabolism," she continued.

"In short, the *T. cruzi* parasite has a means of establishing life insurance once it has invaded the host. If we can fully understand the mechanisms behind this protection, we can begin to explore ways to undermine it with treatment," said Perrin.

Chagas' disease, typically transmitted to humans by blood-feeding insects, infects an estimated 8 to 11 million people throughout Mexico, and Central and South America. Although it is still rare in the United States, according to the Centers for Disease Control and Prevention (CDC), there are 300,000 people with Chagas' disease living in the United States, most of whom acquired the disease while living in other countries.

The acute phase of Chagas' disease can result in fever or swelling at the site of the insect bite, but many people do not experience symptoms at all. If left untreated, the disease enters an indeterminate phase in which no symptoms are present. During this phase, many people are not aware that they are infected, but approximately 30 percent will eventually develop life-threatening complications of the disease, including enlargement of the digestive tract and/or heart.

This study was funded by grants from the National Institute of Neurological Disorders and Stroke (NINDS), a part of the National Institutes of Health.

Story Source:

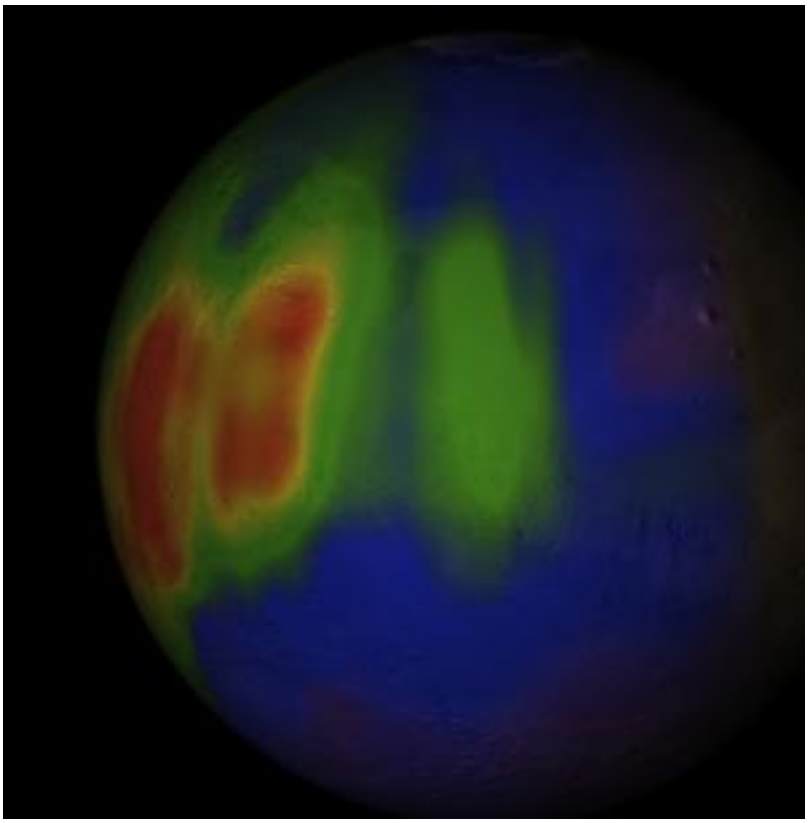
Adapted from materials provided by Tufts University, Health Sciences.

Journal Reference:

1. Chuenkova et al. **Trypanosoma cruzi Targets Akt in Host Cells as an Intracellular Antiapoptotic Strategy**. *Science Signaling*, 2009; 2 (97): ra74 DOI: 10.1126/scisignal.2000374

http://www.sciencedaily.com/releases/2009/12/091208132528.htm

Life on Mars Theory Boosted by New Methane Study



This image shows concentrations of Methane discovered on Mars. (Credit: NASA)

ScienceDaily (Dec. 8, 2009) — Scientists have ruled out the possibility that methane is delivered to Mars by meteorites, raising fresh hopes that the gas might be generated by life on the red planet, in research published in *Earth and Planetary Science Letters*.

Methane has a short lifetime of just a few hundred years on Mars because it is constantly being depleted by a chemical reaction in the planet's atmosphere, caused by sunlight. Scientists analysing data from telescopic observations and unmanned space missions have discovered that methane on Mars is being constantly replenished by an unknown source and they are keen to uncover how the levels of methane are being topped up.

Researchers had thought that meteorites might be responsible for Martian methane levels because when the rocks enter the planet's atmosphere they are subjected to intense heat, causing a chemical reaction that releases methane and other gases into the atmosphere.

However, the new study, by researchers from Imperial College London, shows that the volumes of methane that could be released by the meteorites entering Mars's atmosphere are too low to maintain the current atmospheric levels of methane. Previous studies have also ruled out the possibility that the methane is delivered through volcanic activity.

This leaves only two plausible theories to explain the gas's presence, according to the researchers behind the latest findings. Either there are microorganisms living in the Martian soil that are producing methane gas as a by-product of their metabolic processes, or methane is being produced as a by-product of reactions between volcanic rock and water.

Co-author of the study, Dr Richard Court, Department of Earth Science and Engineering at Imperial College London, says: "Our experiments are helping to solve the mystery of methane on Mars. Meteorites vaporising in the atmosphere are a proposed methane source but when we recreate their fiery entry in the laboratory we get only small amounts of the gas. For Mars, meteorites fail the methane test."

The team say their study will help NASA and ESA scientists who are planning a joint mission to the red planet in 2018 to search for the source of methane. The researchers say now that they have discovered that meteorites are not a source of Methane on Mars, ESA and NASA scientists can focus their attention on the two last remaining options.

Co-author, Professor Mark Sephton, Department of Earth Science and Engineering at Imperial College London, adds: "This work is a big step forward. As Sherlock Holmes said, eliminate all other factors and the one that remains must be the truth. The list of possible sources of methane gas is getting smaller and excitingly, extraterrestrial life still remains an option. Ultimately the final test may have to be on Mars."

The team used a technique called Quantitive Pyrolysis-Fourier Transform Infrared Spectroscopy to reproduce the same searing conditions experienced by meteorites as they enter the Martian atmosphere. The team heated the meteorite fragments to 1000 degrees Celsius and measured the gases that were released using an infrared beam.

When quantities of gas released by the laboratory experiments were combined with published calculations of meteorite in-fall rates on Mars, the scientists calculated that only 10 kilograms of meteorite methane was produced each year, far below the 100 to 300 tonnes required to replenish methane levels in the Martian atmosphere.

This research was funded by a grant from the Science Technology Facilities Council.

Story Source:

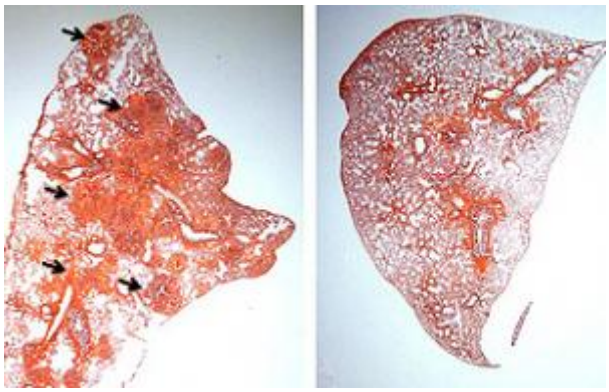
Adapted from materials provided by Imperial College London.

Journal Reference:

1. Richard W. Court, Mark A. Sephton. **Investigating the contribution of methane produced by ablating micrometeorites to the atmosphere of Mars**. *Earth and Planetary Science Letters*, 2009; 288 (3-4): 382 DOI: 10.1016/j.epsl.2009.09.041

http://www.sciencedaily.com/releases/2009/12/091208132349.htm

Tiny RNA Has Big Impact on Lung Cancer Tumors



Let-7 treated lung shows regression of cancer tumors. (Credit: Image courtesy of Yale University)

ScienceDaily (Dec. 8, 2009) — Researchers from Yale University and Mirna Therapeutics, Inc., reversed the growth of lung tumors in mice using a naturally occurring tumor suppressor microRNA. The study reveals that a tiny bit of RNA may one day play a big role in cancer treatment, and provides hope for future patients battling one of the most prevalent and difficult to treat cancers.

"This is the first time anybody has shown a positive effect of microRNAs in shrinking lung cancer," said Frank Slack, Ph.D., co-senior author of the paper, researcher at the Yale Cancer Center and professor of molecular, cellular & developmental biology. The tumors in mice with non-small cell lung cancer shrank after the Yale team delivered an intranasal dose containing a type of micro-RNA called let-7, the authors reported in the Dec. 7 issue of the journal *Oncogene*. MicroRNAs are small bits of genetic material most often associated with transmission of information encoded in DNA. However in the past decade microRNAs have been shown to play crucial roles in gene regulation and/or gene silencing

The Yale team also found that mice without let-7 developed cancer, supporting their hypothesis that the microRNA acts as a tumor suppressor. The tumors in mice that received let-7 were not eliminated, but reduced by 66 percent, the study showed. The team is currently studying whether let-7 therapy in combination with chemotherapy and radiation can induce full remission.

Slack noted let-7 is absent in many cancers and acts upon a gene known to play a role in about a quarter of all human cancers.

"We hope it will be valuable in the treatment of many other forms of cancer," he said.

The research was conducted as part of collaboration between Yale and Mirna Therapeutics Inc, a biotechnology company in Austin, Texas. Joanne B. Weidhaas, MD/Ph.D. of Yale and Andreas G. Bader, Ph.D. of Mirna were co-senior authors of the paper. Other Yale authors on the paper are first author Phong Trang, Pedro P. Medina and Robert Homer; other Mirna authors are Jason F. Wiggins, Lynnsie Ruffino, Kevin Kelnar, Michael Omotola and David Brown, Ph.D.Funding for the work came from the National Institutes of Health, Connecticut Department of Health, The Hope Funds for Cancer Research and Mirna Therapeutics, Inc.

Story Source:

Adapted from materials provided by Yale University.

http://www.sciencedaily.com/releases/2009/12/091207095516.htm

Introns Nonsense DNA May Be More Important to Evolution of Genomes Than Thought

Daphnia pulex is a model organism for genetics study. Its genome was examined for recent intron colonization and loss events. (Credit: Robert Sommer)

ScienceDaily (Dec. 14, 2009) — The sequences of nonsense DNA that interrupt genes could be far more important to the evolution of genomes than previously thought, according to a recent *Science* report by Indiana University Bloomington and University of New Hampshire biologists.

Their study of the model organism *Daphnia pulex* (water flea) is the first to demonstrate the colonization of a single lineage by "introns," as the interrupting sequences are known. The scientists say introns are inserted into the genome far more frequently than current models predict. The scientists also found what appear to be "hot spots" for intron insertion -- areas of the genome where repeated insertions are more likely to occur. And surprisingly, the vast majority of intron DNA sequences the scientists examined were of unknown origin.

"The thinking has been that these insertion events are very rare because they always have bad effects," said postdoctoral fellow Abraham Tucker, a lead author of the *Science* paper.

Graduate student Wenli Li, whose participation in the research overlaps her dissertation work, was the paper's co-lead author. Li said she was particularly interested in the notion of hot spots that make it more likely for separate lineages of *Daphnia* to gain introns in the same place (or the same general area) within the water fleas' genomes. Four of the 23 different kinds of introns the scientists found were not unique with respect to position. If introns were always inserted in random places within genes, the scientists would have expected zero introns to have identical insertion points.

"The most intriguing finding for me is the multiple instances of parallel intron gains, because this means that *Daphnia* is in an active phase of intron proliferation," Li said. "This makes *Daphnia* an extraordinary

system to study intron evolution. In addition, we believe our work facilitates a more accurate estimate of intron gain rates, and directly challenges the assumption that parallel intron gains are rare in many prior analyses."

Whether or not *Daphnia* is typical of eukaryotes with respect to intron gain (and loss), IU Bloomington evolutionary biologist Michael Lynch, the project's principal investigator, agreed that the discovery of parallelism will surprise his colleagues.

"Remarkably, we have found many cases of parallel intron gains at essentially the same sites in independent genotypes," Lynch said. "This strongly argues against the common assumption that when two species share introns at the same site, it is always due to inheritance from a common ancestor."

A unique and important aspect of the scientists' work is that they focused on one species (*Daphnia pulex*). Past studies have looked at a few introns shared by vastly different species. In doing so, geneticists have almost certainly missed the ephemeral appearance of new introns, and therefore would come to the wrong conclusions about how introns are gained, why they are lost, and how frequently either occurs.

That many introns are not acquired from a common ancestor but are the result of separate insertion events, the scientists say, means that the rates of intron gain in any species' lineage could be considerably higher than currently estimated.

Even if the rates of intron gain and loss of introns in *Daphnia pulex* are unlike those found in humans, sunflowers, and mushrooms, the Science report suggests geneticists and genome biologists take another look at introns, some of which could have been the result of hot spot insertion events in separate lines.

"The immediate question will be whether our findings can readily be extended to other species," Lynch said. "We are, in fact, doing that now. In addition, there is need for some solid molecular work to test our hypothesis about the mechanism of intron origin."

Intron is short for "intragenic region," a segment of DNA embedded within the coding portion of a gene. Introns are common in eukaryotic organisms -- animals, plants, fungi, and protists. When genes are expressed, special machinery within the cell nucleus usually removes the introns, thereby producing a transcript of the gene that is devoid of nonsense. Some introns are very small (20 DNA base pairs or fewer). A few introns are shockingly long (nearly 500,000 base pairs) long. Within a gene region, the total length of introns may dwarf the actual coding regions. There's a gene on humans' 22nd chromosome that is so riddled with introns, only 10 percent of it actually contains coding DNA. The rest is comprised of introns.

Scientists have generally assumed introns are so deleterious, their insertion almost always spells doom for the cell lines within individual organisms that produce offspring. With the exception of alternative splicing, introns serve no apparent function and consume needless energy when cells must duplicate all of their DNA. More importantly, the insertion of a new intron in a bad place can interfere with the cellular machinery's expression of an important gene. Experts have taken all of this to mean intron insertions are extremely rare events.

Almost all of the introns the IU Bloomington biologists located possessed a sequence of indeterminate origin. Only one of the 24 identified sequences bore a resemblance to a specific DNA sequences associated either with the *Daphnia* genome or its parasites. The other 23 introns had sequences that appear to have been improvised by the machinery responsible for DNA synthesis. "Our molecular analyses have enabled us to reject a number of hypotheses for the mechanism of intron origins, while clearly indicating an entirely unexpected pathway -- emergence as accidents arising during the repair of double-strand breaks," Lynch said.

Abraham Tucker, now at Indiana University Bloomington, and paper co-author Way Sung were both graduate students of William Kelley Thomas at the University of New Hampshire's Hubbard Center for Genome Studies when they did the bioinformatic analysis of the *Daphnia* genome that led to the findings of this paper. Drawing on longtime collaborations between Lynch's lab and the Hubbard Center on the *Daphnia* genome project, the two were able to access all *Daphnia* genome sequences.

"It was a very intense analysis, but it was obvious within a few days that there was some very interesting data," says Thomas, who is Hubbard Professor in Genomics and director of the Hubbard Center for Genome Studies. "This was a wonderful collaborative project."

This research was funded with grants from the National Science Foundation.

Story Source:

Adapted from materials provided by Indiana University.

Journal Reference:

1. Li et al. **Extensive, Recent Intron Gains in Daphnia Populations**. *Science*, 2009; 326 (5957): 1260 DOI: 10.1126/science.1179302

http://www.sciencedaily.com/releases/2009/12/091210111148.htm

Can Biodiversity Persist In The Face Of Climate Change?

Studies of likely survival rates of alpine plants have highlighted the difficulty of predicting the fate of biodiversity. (Credit: Image courtesy of University of Oxford)

ScienceDaily (Dec. 14, 2009) — Predictions made over the last decade about the impacts of climate change on biodiversity may be exaggerated, according to a paper published in the journal *Science*.

Oxford University researchers, Professor Kathy Willis and Dr Shonil Bhagwat, argue that predicting the fate of biodiversity in the face of climate change is 'fraught with caveats and complexities'.

They say that several larger-scale models are failing to take into account local, more detailed variations and that models often underestimate the full capacity of plants and animals to adapt to a changing climate.

The researchers' view is that these factors 'seriously alter the model predictions'. They suggest that 'we should expect to see species turnover, migrations, and novel communities, but not necessarily the levels of extinction previously predicted'.

Their synthesis of research highlights the contradictions in previous studies about the likely survival rates of alpine plants in the Swiss Alps, European butterfly populations and the South American tropical rainforests.

'These studies highlight the level of complexity that we are faced with in trying to model and predict the possible consequences of future climate change on biodiversity,' the paper says. The researchers say the mixed picture that is emerging from previous studies also emphasises a high level of persistence in many communities.

Although over three quarters of the earth's deserts, grasslands, forests and tundra have changed because of human activity, the researchers say that even in this fragmented landscape species are surviving better than was previously predicted. The paper cites more recent studies and concludes that even in altered landscapes 'all is not lost for biodiversity'.

The researchers point to a study into 785 animal species across six continents, which suggests the most important factor for occupancy is the quality of the animals' immediate environment rather than whether their habitat is shrinking. Their paper also highlights a study of forest butterflies in West Africa, which found that despite an 87 per cent reduction in forest cover, 97 per cent of species are still present.

Professor Kathy Willis, from the School for Geography and the Environment, expresses some caution about the apparent ability of species to survive in a more fragmented habitat. She said: 'Presence or absence does not take into account lag effects of declining populations. Therefore, a more worrying interpretation is that the full effects of fragmentation will only be seen in future years.'

The paper also highlights a serious issue for future conservationists, arguing that the definition of 'natural' is changing fast.

Dr Shonil Bhagwat, from the School of Geography and the Environment, said: 'Although every measure should be put in place to reduce the further fragmentation of reserves, we cannot turn back the clock. We need to determine what represents a "good" intervention to preserve animal habitats in the countryside and in towns and cities. Furthermore, we will increasingly see new ecosystems emerging as a result of climate changes and so what is "natural" is going to require a whole new definition.'

Story Source:

Adapted from materials provided by University of Oxford.

http://www.sciencedaily.com/releases/2009/11/091106111214.htm

Scientists Crack Mystery of Protein's Dual Function

ScienceDaily (Dec. 14, 2009) — Researchers at The Scripps Research Institute have solved a 10-year-old mystery of how a single protein from an ancient family of enzymes can have two completely distinct roles in the body. In addition to providing guidance for understanding other molecules in the family, the research supplies a theoretical underpinning for the protein's possible use for combating diseases including cancer and macular degeneration.

The research was published in the December 13, 2009 advance, online issue of the high-impact journal *Nature Structural and Molecular Biology*.

The scientists, led by Scripps Research Associate Professor Xiang-Lei Yang, focused on a molecule called human tryptophanyl-tRNA synthetase (TrpRS), finding that it contains a "functional switch" that enables it to perform two different functions. In one of its forms, the molecule acts to facilitate protein synthesis. In the second form, the same molecule works to inhibit the formation of new blood vessels -- an effect that, if successfully harnessed, could be medically useful.

"I'm very excited about these findings," said Yang. "This piece of work provides a very deep mechanistic understanding. It has really shown that the activity of this tRNA synthetase is of biological significance and that it's a good example of the many, many different functions that have been found with the tRNA synthetase family."

One Enzyme, Two Functions

For some time, scientists have known that the aminoacyl tRNA synthetase family is composed of 20 ancient enzymes that attach the correct amino acid to a tRNA as the first step in the synthesis of proteins.

The mystery of the protein family's dual functionality, however, was born about a decade ago, with the publication of a 1999 paper in the journal Science by Paul Schimmel, who is Ernest and Jean Hahn Professor of Molecular Biology and Chemistry and a member of The Skaggs Institute for Chemical Biology at Scripps Research, in collaboration with a member of his lab at that time, Keisuke Wakasugi.

In the 1999 paper, Wakasugi and Schimmel showed that a member of the human aminoacyl-tRNA synthetase family, tyrosyl-tRNA synthetase (TyrRS), did more than adding the amino acid tyrosine to a protein chain during protein synthesis. In addition, a fragment of the protein could function to attract immune cells and to stimulate the growth of blood vessels.

The findings were met with astonishment and some skepticism in the scientific community.

Soon afterward, however, the Schimmel lab showed that another member of the family, TrpRS, also had a dual function. In addition to its role adding the amino acid tryptophan to a protein chain during protein synthesis, a fragment of TrpRS could inhibit new blood vessel formation.

Since that time, there has been considerable therapeutic interest in TyrRS, TrpRS, and other members of the aminoacyl-tRNA synthetase family. As a pro-angiogenic factor, the TyrRS fragment could be useful in diseases where growth of blood vessels is desirable, such as in some forms of heart disease or peripheral artery disease. Likewise, the TrpRS fragment's anti-angiogenic effects could help patients reduce undesirable blood vessel growth in diseases such as cancer and a great many eye diseases that lead to catastrophic vision loss.

In fact, fragments of TrpRS were used as part of a study led by Scripps Research Professor Martin Friedlander that successfully halted the progression in animal models of highly vascular brain tumor and neovascular eye disease (PNAS 2007 104:967-972).

Despite the interest in tRNA synthetases, however, no one has been able to figure out exactly how they perform their different roles -- until now.

Mystery Mechanism Revealed

In the current study, the research team used a combination of techniques including structural modeling analysis, mutagenesis, and cell-based functional studies to unravel the secrets of TrpRS.

The scientists identified the specific molecular changes that enabled TrpRS to perform one function or another.

In the study, the scientists show that, for its role in protein synthesis, TrpRS is typically in its full-length form. This form of the molecule contains a tryptophan-binding pocket that enables it to bind with the amino acid and shepherd it to where it is needed in protein synthesis.

In the second active form, however, the protein must first be broken into fragments by the body, creating a piece called T2-TrpRS. With the removal of the end of the full-length protein (the N-domain), new grooves in the T2-TrpRS protein fragment are revealed. Containing the now-exposed tryptophan-binding pocket, the grooves fit together with side chains of another molecule, VE-cadherin -- known to be indispensable for proper vascular development.

Interestingly, the new study found that tryptophan acts to inhibit of the vasculature function of TrpRS, locking the protein into its protein-synthesis form.

Therapeutic Potential

Yang notes that the therapeutic potential of TrpRS and other tRNA synthetases are particularly good because they normally exist in abundant amounts in the body.

"Naturally, you'd imagine the body's tolerance for such a protein is pretty good," she said, "and we could use the activated form of the molecule."

In addition, Yang points out that TrpRS is intriguing because it does not effect existing blood vessel growth, only new blood vessel formation, reducing the odds of negative side effects from its use.

This work was supported by the National Institutes of Health, and by a fellowship from the National Foundation for Cancer Research.

Story Source:

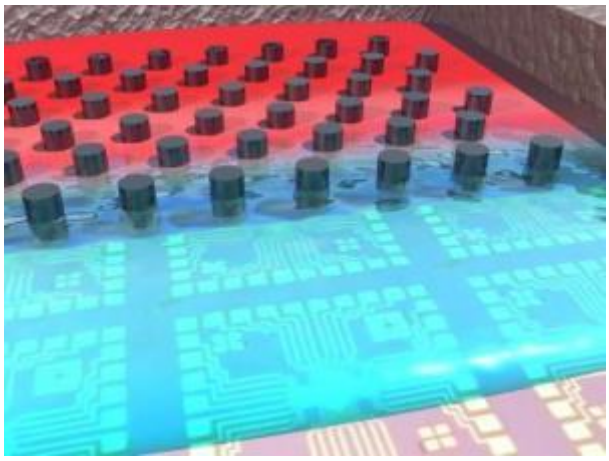
Adapted from materials provided by Scripps Research Institute, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Zhou et al. **Orthogonal use of a human tRNA synthetase active site to achieve multifunctionality**. *Nature Structural & Molecular Biology*, 2009; DOI: 10.1038/nsmb.1706

http://www.sciencedaily.com/releases/2009/12/091213164713.htm

Nanosensors Used to Measure Cancer Biomarkers in Blood for First Time



Blood is filtered and transferred to nanosensors on a chip, which can detect and measure cancer biomarkers. (Credit: Mark Reed/Yale University)

ScienceDaily (Dec. 14, 2009) — A team led by Yale University researchers has used nanosensors to measure cancer biomarkers in whole blood for the first time. Their findings, which appear December 13 in the advanced online publication of *Nature Nanotechnology*, could dramatically simplify the way physicians test for biomarkers of cancer and other diseases.

The team -- led by Mark Reed, Yale's Harold Hodgkinson Professor of Engineering & Applied Science, and Tarek Fahmy, an associate professor of biomedical and chemical engineering -- used nanowire sensors to detect and measure concentrations of two specific biomarkers: one for prostate cancer and the other for breast cancer.

"Nanosensors have been around for the past decade, but they only worked in controlled, laboratory settings," Reed said. "This is the first time we've been able to use them with whole blood, which is a complicated solution containing proteins and ions and other things that affect detection."

To overcome the challenge of whole blood detection, the researchers developed a novel device that acts as a filter, catching the biomarkers -- in this case, antigens specific to prostate and breast cancer -- on a chip while washing away the rest of the blood. Creating a buildup of the antigens on the chip allows for detection down to extremely small concentrations, on the order of picograms per milliliter, with 10 percent accuracy. This is the equivalent of being able to detect the concentration of a single grain of salt dissolved in a large swimming pool.

Until now, detection methods have only been able to determine whether or not a certain biomarker is present in the blood at sufficiently high concentrations for the detection equipment to give reliable estimates of its presence. "This new method is much more precise in reading out concentrations, and is much less dependent on the individual operator's interpretation," Fahmy said.

In addition to relying on somewhat subjective interpretations, current tests are also labor intensive. They involve taking a blood sample, sending it to a lab, using a centrifuge to separate the different components, isolating the plasma and putting it through an hours-long chemical analysis. The whole process takes several days. In comparison, the new device is able to read out biomarker concentrations in a just a few minutes.

"Doctors could have these small, portable devices in their offices and get nearly instant readings," Fahmy said. "They could also carry them into the field and test patients on site."

The new device could also be used to test for a wide range of biomarkers at the same time, from ovarian cancer to cardiovascular disease, Reed said. "The advantage of this technology is that it takes the same effort to make a million devices as it does to make just one. We've brought the power of modern microelectronics to cancer detection."

Authors of the paper include Eric Stern, Aleksandar Vacic, Nitin Rajan, Jason Criscione, Jason Park, Mark Reed and Tarek Fahmy (all of Yale University); Bojan Ilic (Cornell University); David Mooney (Harvard University).

Story Source:

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

Journal Reference:

1. Eric Stern, Aleksandar Vacic, Nitin K. Rajan, Jason M. Criscione, Jason Park, Bojan R. Ilic, David J. Mooney, Mark A. Reed, Tarek M. Fahmy. **Label-free biomarker detection from whole blood**. *Nature Nanotechnology*, 2009; DOI: 10.1038/nnano.2009.353

http://www.sciencedaily.com/releases/2009/12/091213164709.htm

Innovative Plan To Save Rainforest, Reduce Greenhouse Gas Emissions

Napo River in Ecuador, part of the Amazon region in South America. (Credit: iStockphoto/Steven Miric)

ScienceDaily (Dec. 14, 2009) — An innovative proposal by the Ecuadorian government to protect an untouched, oil rich region of Amazon rainforest is a precedent-setting and potentially economically viable approach, says a team of environmental researchers from the University of Maryland, the World Resources Institute and Save America's Forests.

The Ecuadorian proposal, known as the Yasuní-ITT Initiative, would protect a large area of pristine Amazon rainforest, by leaving untouched nearly one billion barrels of oil that lies beneath the Yasuní National Park in Ecuador. Under the initiative, the government would sell certificates linked to the value of the unreleased carbon to provide alternative revenue to that which would come from exploiting the oil reserves.

"This is a really novel approach that could fund a lot of rainforest protection," said Clinton Jenkins, a research scientist in the University of Maryland's department of biology. "It's also an innovative way of dealing with greenhouse gas emissions."

"There has been a lot of talk about engineering ways to reduce or offset greenhouse gas emissions by removing carbon from air and burying, or sequestering, it in the ground. This approach sequesters carbon by preventing oil from ever getting out of the ground," said Jenkins.

Writing about the Yasuní-ITT Initiative in a new article in the scientific journal *Biotropica*, Jenkins, Matt Finer of Save America's Forests and Remi Moncel with the Climate and Energy Program of the World Resources Institute, say that a number of climate researchers, including NASA scientist James Hansen,

have suggested that forgoing extraction of oil and gas reserves in remote or sensitive places could be an important piece to a larger global strategy designed to limit carbon emissions and that this Initiative "is the first real offer to do just that."

"Oil and gas concessions now cover vast swaths of the mega-diverse western Amazon," said Finer, lead author of *Biotropica* review article. "Ecuador´s revolutionary initiative is the first major government-led effort to buck this disturbing trend."

According to estimates of Ecuadorian officials cited in the article, preventing exploitation of the ITT oil fields, will keep 410 million metric tons of CO_2 out of the atmosphere.

The authors note that use of a conservation strategy like that proposed by Ecuador would be particularly beneficial in areas that also offer great ecological value. The Yasuní National Park has such multiple benefits, they say, because it is one of the most biodiverse parts of the Amazon and within the territory of some of the world's last un-contacted indigenous peoples, the Tagaeri and Taromenane.

"Yasuní is an exceptional place in the world, biologically incredible, home to un-contacted peoples, and yet -- perhaps tragically -- full of oil," said Jenkins. "Society faces a test of what we value more, drilling for more oil, or preserving a cherished national park and the people who call it home."

Skeptics and Advocates

The Ecuadorian proposal has been lauded widely for its three-pronged effort to protect biodiversity, respect indigenous peoples' territory, and combat climate change. However, Jenkins, Finer and Moncel note that the Yasuní-ITT Initiative also has ardent skeptics.

For example, how to pay for the effort is in question. Ecuador, a country highly dependent on oil export revenues, seeks $350 million for each of the next 10 years in alternative revenue. Ecuador's intent is to sell certificates linked to the value of the unreleased carbon. This raises a number of technical questions, however, such as the possibility that the initiative would not result in a net global CO_2 reduction if the certificates were traded in carbon markets.

"The best way to minimize the risk associated with the carbon bonds is to encourage supporters to make direct donations," said Remi Moncel of the World Resources Institute. "While less problematic from the point of view of environmental integrity, it is harder to raise money that way."

Germany appears to be a leading supporter of the Yasuní-ITT Initiative. Recent news reports indicate the German government may donate $50 to $70 million annually to the initiative if other countries also agree to provide support for the initiative.

Additional questions tackled in the study include why a national park is on the chopping block in the first place and what mechanisms are needed to prevent future Ecuadorian administrations from drilling the oil fields.

The authors conclude that the Yasuní-ITT Initiative, with its focus on generating alternative revenue, is a potentially precedent-setting advance in avoiding damaging oil and gas development in sensitive areas and an innovative way to address climate change.

"The climate conference of Copenhagen is only weeks away. What Ecuador has proposed is a good example of how each country can come up with home-grown, nationally relevant ideas to promote sustainable development," said Moncel.

Authors Finer and Jenkins recently published a companion study entitled, "Ecuador's Yasuní Biosphere Reserve: a brief modern history and conservation challenges." It is a concise history of the Yasuní region designed to help people better understand this complicated part of the world. That article appeared in *Environmental Research Letters*.

For more information, see: http://www.saveamericasforests.org/Yasuni/ITT-Links.htm

Story Source:

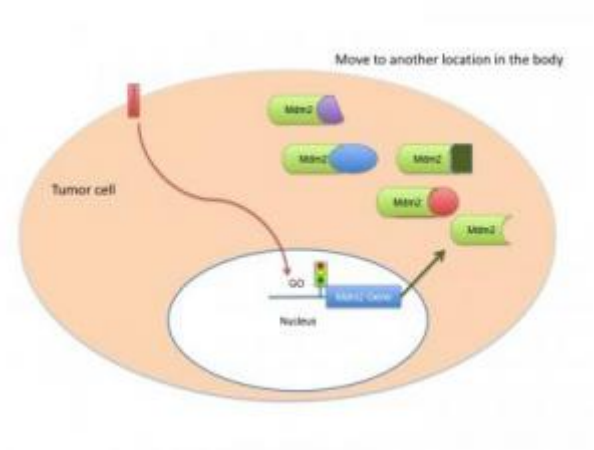
Adapted from materials provided by University of Maryland.

Journal References:

1. Matt Finer, Varsha Vijay, Fernando Ponce, Clinton N Jenkins, Ted R Kahn. **Ecuador's Yasuní Biosphere Reserve: a brief modern history and conservation challenges**. *Environmental Research Letters*, 2009; 4 (3): 034005 DOI: 10.1088/1748-9326/4/3/034005
2. Matt Finer, Remi Moncel, Clinton N. Jenkins. **Leaving the Oil Under the Amazon: Ecuador's Yasuní-ITT Initiative**. *Biotropica*, 2009; DOI: 10.1111/j.1744-7429.2009.00587.x

http://www.sciencedaily.com/releases/2009/11/091105143823.htm

New Understanding of How to Prevent Destruction of a Tumor Suppressor



This graphic depicts the hardwiring that causes Mdm2 to increase and bind and inactivate several proteins in cancer. (Credit: Lindsey Mayo, Ph.D., Indiana University School of Medicine)

ScienceDaily (Dec. 14, 2009) — Researchers from the Indiana University School of Medicine and colleagues at the University of Texas Southwestern and Case Western University have determined how the protein Mdm2, which is elevated in late-stage cancers, disables genes that suppress the growth of tumors. The finding may lead to the development of new drugs for late stage breast cancer and other difficult to treat malignancies.

The investigators have identified a critical pathway that stimulates the production of Mdm2 causing an increase in the level of protein that bind to p53, the most common tumor suppressor, as well as other tumor suppressors, and extinguishes tumor suppression activity. The study appears in the January 2010 issue of the *Journal of Clinical Investigation.*

Principal investigator Lindsey Mayo, Ph.D., assistant professor of pediatrics at the Herman B Wells Center for Pediatric Research at the IU School of Medicine and an Indiana University Melvin and Bren Simon Cancer Center member, says that keeping Mdm2 inactive and preventing the destruction of the tumor suppressor that Mdm2 targets, is critical to preventing cancer from spreading within the body.

To explain the role of Mdm2 and how the newly identified pathways function, Dr. Mayo uses the analogy of a florescent ceiling fixture in which Mdm2 is the fluorescent bulb. "Initially, it was only known that the light was on, not how it was turned on. We discovered the wall switch and wires that connect to the light fixture to turn on the fluorescent light."

"This work provides new evidence about an important mechanism that tumor cells use to promote metastasis. While it has long been known that the loss of tumor suppressor activity triggers cancer, knowledge of how these cancer inhibitors are turned on and off has eluded researchers. Understanding the signaling pathways that elevate Mdm2 is critical to preventing cancer from spreading within the body and key to attacking many late stage cancers," said Dr. Mayo, a molecular biochemist who studies the mechanisms that control tumor suppressors.

While it is too early to speculate on which chemical compounds may yield successful drugs, Dr. Mayo says this new insight into Mdm2 and its pathways provides a useful roadmap to stimulate development of new compounds which could bind to Mdm2 to inhibit the protein and stop its attacks on tumor suppressors.

In addition to Dr. Mayo, co-authors of the study, which was funded by the National Cancer Institute, are medical student Jacob A. Eitel, graduate student Christopher N. Batuello, Khadijeh Bijangi-Vishehsaraei,

Ph.D. and Karen E. Pollok, Ph.D. of the IU School of Medicine, Shinako Araki, Ph.D. , Xian-Jin Xie Ph.D., and David A. Boothman, Ph.D. of the University of Texas Southwestern Medical Center; and David Danielpour, Ph.D. of Case Western Reserve University.

The Wells Center is the research arm of the IU School of Medicine Department of Pediatrics and Riley Hospital for Children. The IU School of Medicine, the Wells Center, Riley Hospital and the IU Simon Cancer Center are located on the campus of Indiana University-Purdue University Indianapolis.

Story Source:

Adapted from materials provided by Indiana University School of Medicine, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Shinako Araki, Jacob A. Eitel, Christopher N. Batuello, Khadijeh Bijangi-Vishehsaraei, Xian-Jin Xie, David Danielpour, Karen E. Pollok, David A. Boothman and Lindsey D. Mayo. **TGF-β1–induced expression of human Mdm2 correlates with late-stage metastatic breast cancer**. *Journal of Clinical Investigation*, 2010; 120 (1): 1-14 DOI: 10.1172/JCI39194

http://www.sciencedaily.com/releases/2009/12/091201182612.htm

Health Effects of Low-Intensity Warfare Studied

Turkana women in northern Kenya. (Credit: Matthias Oesterle)

ScienceDaily (Dec. 14, 2009) — For nearly two decades, Ivy Pike, an associate professor of anthropology at the University of Arizona, has been studying ethnic groups in rural northern Kenya to understand how violence shapes the health of those eking out a living there.

The results of her and her colleagues' research," Documenting the health consequences of endemic warfare in three pastoralist communities of northern Kenya: A conceptual framework," is currently published in a special edition of *Social Science and Medicine,* in collaboration with the British medical journal *The Lancet* and the *Journal of the Danish Medical Association.*

These studies also set the stage for Global Response 2010, an international conference on violent conflict and health worldwide. The conference begins Jan. 22 in Copenhagen and is geared for humanitarian workers, physicians, political leaders and academicians working on violence and health.

Pike said their paper offers a "conceptual framework that lays out the importance of methods and approaches to document violence." While considerable research has documented social responses to the ongoing and chronic warfare among groups, there is much less data on how conflict affects community health.

Pike has been studying three nomadic communities -- the Pokot, Samburu and Turkana. Like other groups that live in northen Kenya, all are pastoralists, herding cattle, goats, sheep and camels between pasture and water. The region, about the size of Texas, has virtually no infrastructure. Literacy hovers at between 7 and 8 percent.

For hundreds of years, friction between these groups has centered largely on access to scarce grazing and water, and by livestock theft. Persistent drought over the last several years has raised tensions all the more, aggravated further by the introduction of firearms, especially automatic weapons in recent years.

Pike said that households she first studied in the early 1990s that might have had military-issue rifles, by mid-decade all had AK-47s.

"It's easy to treat this violence as cattle rustling, but it's much more complicated, with disparate impacts on people's daily lives and health," Pike said.

"We're documenting nutritional change over time. That's important because families that are nomads are very dependent on their livestock, so any shift in holdings or their animals' access to food and water impacts food security," she said.

While young men are killed or wounded by gunfire in raids, Pike said women and children also bear a considerable load from the violence. "The tendency is to say more young men are dying, but I can't substantiate that at this point. It looks like the fallout for women and children is just as high."

Men generally have better health because they travel with the herds and consequently have better access to meat and milk. Women will sacrifice to feed their children and older women will protect young mothers. All women will forego food when their children are hungry. This makes women an important barometer of health and well-being, especially when their specific group has born the brunt of a violent attack.

Still, there is almost no data on the links between violence and armed conflict to shifts in health. Pike said pursuing this line of research has implications for many of the under-developed and developing regions of the world, especially in sub-Saharan Africa and Asia, where violence has increased dramatically related to displaced populations.

Story Source:

Adapted from materials provided by University of Arizona. Original article written by Jeff Harrison.

Journal Reference:

1. Pike et al. **Documenting the health consequences of endemic warfare in three pastoralist communities of northern Kenya: A conceptual framework**. *Social Science & Medicine*, 2010; 70 (1): 45 DOI: 10.1016/j.socscimed.2009.10.007

http://www.sciencedaily.com/releases/2009/12/091211131613.htm

Syntax in Our Primate Cousins

Female Cercopithecus campbelli campbelli in captivity. (Credit: Copyright A. Laurence)

ScienceDaily (Dec. 13, 2009) — A study carried out in Ivory Coast has shown that monkeys of a certain forest-dwelling species called Campbell's monkeys emit six types of alert calls. The primates combine these calls into long vocal sequences which allow them to convey messages about social cohesion or various dangers, including predation.

These results, obtained by researchers at the Ethologie Animale et Humaine research group (CNRS / Université Rennes 1), working with the universities of St Andrews in Scotland and Cocody-Abidjan in Ivory Coast, were published on the website of the *Proceedings of the National Academy of Sciences.* The results reveal the most complex example of "proto-syntax" yet discovered in a non-human species.

For two years, at the Taï Monkey Project research station in the Taï national park in Ivory Coast, researchers studied the behavior of Campbell's monkeys (*Cercopithecus campbelli campbelli*). These monkeys live in small groups of ten or so individuals, made up of an adult male, several adult females and their progeny.

Researchers from the Ethologie Animale et Humaine research group (CNRS / Université de Rennes 1), working with a psychologist and an ethologist from the universities of St Andrews in Scotland and Cocody-Abidjan in Ivory Coast, studied the loud calls of adult males, whose vocal repertory is very different from that of females. They observed the vocal response of males to various disturbances of their environment, notably encounters with natural predators (like the eagle and leopard). They also carried out visual simulation experiments (with stuffed leopards and eagles) as well as acoustic experiments (using a loud-speaker amplifying leopard or eagle calls and grunts) suggesting the presence of these predators.

These experiments showed that males have a repertory of six types of alert calls (Boom, Krak, Hok, Hok-oo, Krak-oo, Wak-oo) but only rarely use them in isolation, preferring to produce long vocal sequences of an average of 25 successive calls (each sequence being made up of 1 to 4 types of different calls). Furthermore, Campbell's monkeys combine calls in order to convey different messages. By modifying a call sequence or the order of calls within a sequence, the messages are changed, and can relay precise information about the nature of the danger (a falling tree, a predator), the type of predator (eagle, leopard), how the predator was detected (acoustically, visually) but also about social events unrelated to predation (gathering before the group moves to another site, an encounter with another group of the same species at territory boundaries...).

This study shows the capacity of this monkey species for very complex vocal communication, both in the range of transmitted messages and in the techniques used to encode these messages. The same team of researchers had previously shown that males used a suffix "oo" to duplicate the size of his vocal repertory (which allowed them to produce the sounds Hok and Krak as well as Hok-oo and Krak-oo). In this new study, the ethologists explain some of the rules that govern the semantic combinations of calls. For example, Campbell's monkeys can add a particular type of call to an existing sequence in order to make the message more precise or to alter it. They can also combine sequences relaying different messages in order to convey a third message.

This ability to combine calls may have appeared during the monkeys' evolution to compensate for limited vocal flexibility (monkeys have less vocal flexibility than birds and cetaceans) and provide a way to encode new messages. This study shows a form of proto-syntax in this tree-dwelling monkey species which, as they live in a habitat with limited visibility, can only communicate vocally. This study raises the question of the potential existence of precursors to human language in animal vocal communication.

Story Source:

Adapted from materials provided by CNRS.

http://www.sciencedaily.com/releases/2009/12/091212144710.htm

How Can Some Athletes Play on Through Intense Pain?

Illustration incorporating real image of pain MRI scan (far left). (Credit: Image courtesy of University of Oxford / Pain scan image from research by Irene Tracey)

ScienceDaily (Dec. 13, 2009) — How can some sportsmen and women, in the heat of the moment, play on through pain that would floor anyone else?

Bert Trautmann, the Manchester City goalkeeper, famously played on through to the end of the 1956 FA Cup final -- holding on for a 3-1 win -- despite suffering a broken neck from a collision in the second half.

Similarly, why do some people seem to suffer long-lasting debilitating pain when others are better able to cope? Each of us individually can also experience pain differently at different times.

Pain of course is a subjective, variable and very personal experience that involves far more than a simple reaction to injury or damage. And although doctors can only rely on what each patient says about the pain that they're experiencing, it is important to try and diagnose, monitor and manage that pain effectively.

Professor Irene Tracey's group at the Oxford Centre for Functional Magnetic Resonance Imaging of the Brain has used brain imaging techniques for a number of years, aiming to provide an objective measure of individual experiences of pain.

By understanding how the brain processes the information coming from all the body's senses as pain, they can begin to pick out differences between people.

Their latest results, recently reported in the journal *PNAS*, demonstrate that people's personalities matter in their experience of pain. People that are more anxious, or worried about feeling pain, have differences in connectivity within their brains that make them more susceptible to actually feeling pain.

The team applied short laser pulses to the feet of 16 willing and healthy volunteers just at the point where they started to experience the pulses as being painful ('you can ratchet up the laser pulses so you feel them as warm, then hot, then the point where you say "yeah, actually, that hurts now,"' explains Irene.) These brief laser pulses were applied 120 times to each volunteer, and around half the time the volunteer would declare it was painful and half the time not -- even though the pulse was exactly the same every time.

MRI brain scans during these experiments show that the volunteers' brains were more active in pain-processing regions when they described the laser pulses as being painful -- so this was a real experience and not down to any report bias or artefact.

But the researchers wanted to understand exactly what made one stimulus painful at one time while the very same stimulus at another time was fine.

'We looked at the period just before the stimulus and asked "is there a difference in the way certain regions of the brain are connected or communicating before the stimulus is applied?"' explains Irene. 'The answer is that there is a striking difference.'

The researchers focused on the connection between 'higher' parts of the brain involved in the processing of pain, and part of the brain stem that can powerfully alter the experience of pain -- turning its level up or down.

When there was good coupling between the two areas before a laser pulse, the volunteer felt no pain, and when the connectivity was poor, the pulse was experienced as painful.

Most interestingly of all, however, was that people that were more likely to be anxious or vigilant about pain (as scored on their answers to a questionnaire for these traits), showed poorer connectivity in general between these brain regions.

This difference in the hardwiring of the brain could account for how people with different personalities respond to pain, suggests Irene.

'We now want to know whether we are born with this, or whether the brain becomes wired like this as it develops,' she says. 'It's a chicken and the egg situation. We only have a snapshot in time with this experiment. We can't tell what comes first.'

Story Source:

Adapted from materials provided by University of Oxford. Original article written by Jonathan Wood.

http://www.sciencedaily.com/releases/2009/12/091212145909.htm

Bacteria Provide New Insights Into Human Decision Making

Colonies of billions of Bacillus subtilis bacteria exhibit the complex structures that sometimes form under environmental stress. (Credit: Eshel Ben Jacob)

ScienceDaily (Dec. 13, 2009) — Scientists studying how bacteria under stress collectively weigh and initiate different survival strategies say they have gained new insights into how humans make strategic decisions that affect their health, wealth and the fate of others in society.

Their study, recently published in the early online edition of the journal *Proceedings of the National Academy of Sciences,* was accomplished when the scientists applied the mathematical techniques used in physics to describe the complex interplay of genes and proteins that colonies of bacteria rely upon to initiate different survival strategies during times of environmental stress. Using the mathematical tools of theoretical physics and chemistry to describe complex biological systems is becoming more commonplace in the emerging field of theoretical biological physics.

The authors of the new study are theoretical physicists and chemists at the University of California, San Diego's Center for Theoretical Biological Physics, the nation's center for this activity funded by the National Science Foundation, and Tel Aviv University in Israel. They say that how genes are turned on and off in bacteria living under conditions of stress not only shed light on how complex biological systems interact, but provide insights for economists and political scientists applying mathematical models to describe complex human decision making.

"Everyone knows the need to try to postpone important decisions until the last moment but apparently there are simple creatures that do it well and therefore can really teach us -- the bacteria," said Eshel Ben Jacob, a physics professor at Tel Aviv University and a fellow of the Center for Theoretical Biological Physics. He co-authored the study with three other scientists at the center: José Onuchic, a professor of physics at UCSD and a co-director of the center, Peter Wolynes, a professor of physics and chemistry at UCSD and Daniel Schultz, a postdoctoral researcher at UCSD.

In nature, bacteria live in large colonies whose numbers may reach up to 100 times the number of people on earth. Many bacteria respond to extreme stress -- such as starvation, poisoning and irradiation -- by creating spores, dormant states that are highly resistant to the outside environment and that can germinate into fully functioning bacteria once the environment improves. The response involves more than 500 genes and takes about 10 hours in *Bacillus subtilis*, the bacterium used by the scientists in their study.

Each bacterium in the colony communicates via chemical messages and performs a sophisticated decision making process using a specialized network of genes and proteins. Modeling this complex interplay of genes and proteins by the bacteria enabled the scientists to assess the pros and cons of different choices in game theory, a branch of mathematics that attempts to model decision making by humans, in which an individual's success in making choices depends on the choices of others.

When bacteria form spores, the mother cell dies, but not before it stores a copy of its DNA in a special capsule called the spore. The mother cell then breaks open and its DNA and remaining proteins are released to the environment. The bacteria on the road to spore formation don't always form spores. They can change their fate and escape into a different state called "competence."

In this state, the bacteria change their membranes to allow the easy absorption of material from the dying cells. This allows for the creation of a "competence intermediate state," in which the bacteria hope to survive even under these unfriendly conditions. When normal conditions are restored, bacteria return to normal life without having to make a spore. The advantage of this situation is the ability of quickly returning to normality, but there is also a disadvantage: Likely death if the conditions get even worse. As a result, each bacterium has a dilemma.

"It pays for the individual cell to take the risk and escape into competence only if it notices that the majority of the cells decide to sporulate," explained Onuchic. "But if this is the case, it should not take this chance because most of the other cells might reach the same conclusion and escape from sporulation. Observations have shown that indeed only about 10 percent of the bacteria enter into competence. But how they make this decision and which cells take this chance have been a mystery."

The researchers discovered in their study that the bacteria's game theory decision making process is far more advanced than the well-known game theory problem known as the Prisoner's Dilemma.

Classic Prisoner's Dilemma, when applied to two prisoners, gives them the following offer: If only one prisoner pleads guilty, the one that cooperates gets two years in jail while the other one gets six years. If both of them admit guilt, then they will be imprisoned for four years. However, if none of them pleads guilty, they go free with no punishment. The temptation is not to admit anything, but the prisoners never know whether or not the other prisoner cooperated and pled guilty.

Because the number of participants in a bacterial colony can be up to 100 times the number of people on earth, the bacteria need to construct a more complex form of game theory. The rapidly changing environmental conditions they face means also bacteria have limited time to decide.

"Prisoner's Dilemma for bacteria is more complex," said Ben Jacob. "Each bacterium must decide whether to become a spore; that is, to cooperate, or escape into competence, or take advantage of the others, while it has a limited time to decide while a clock is ticking. We discovered that each cell has an internal timer whose pace changes according to the stress it experiences -- the pace goes up for higher stress decisions such as in humans. Our internal clock speeds up under danger because of the secretion of adrenaline and therefore we have the sensation of time slowing down. In addition to internal stress, each bacterium adjusts the pace of its timer accordingly to the stress of its peers and their intention to sporulate or to go into competence."

According to Onuchic, bacteria usually do not cheat their friends and inform them by sending chemical messages about their true intensions.

"We have developed for the first time a system level model of a large gene network to decipher the underlying principles of the bacteria game theory and how an internal network of genes and proteins is used to calculate risks in this complicated situation," he said.

This has applications to human society because many people encounter similar dilemmas during their own lives. For example, should people ignore side effects and vaccinate against a new potentially lethal virus or should they not vaccinate and take the risk of being infected with the possible consequences? If the majority of the population is going to get vaccinated, then it is better for each individual not to get vaccinated. However, if most people will not be vaccinated then it is better to be vaccinated.

"What each bacterium is doing is the equivalent if each individual on earth was able receive the exact information about the rate of spread of this new virus, the exact information about the intensions, to be vaccinated or not, by each person on the planet, and in addition the exact information about the health risks of side effects or being infected," said Ben Jacob. "A decision is then made in the context of this vast amount of information."

"We have shown how the bacteria do this complex calculation according to well-defined principles," added Onuchic. "We learned a simple rule: Anyone who needs to make a decision under pressure in life, especially if it is a possible death decision, will take its time. She or he will review the trends of change, will render all possible chances and risks, and only then react."

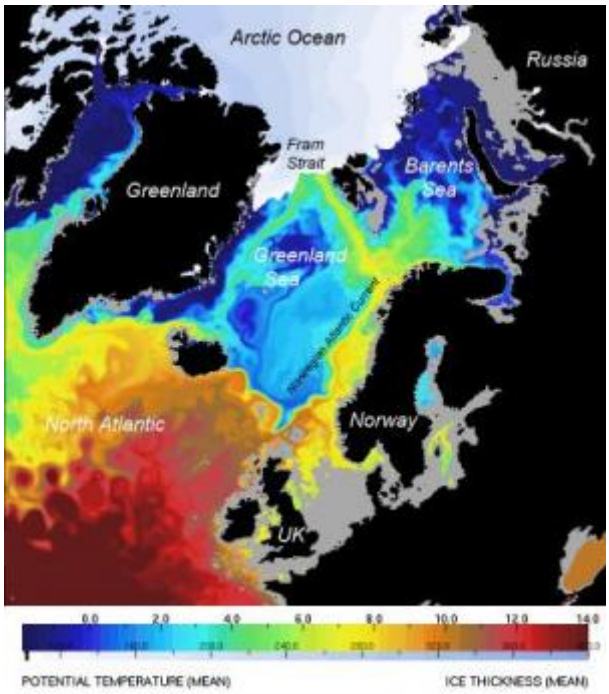
"Another interesting fact is that the same cells in the same environment, in this case, bacteria in the colony, can actually in a statistical matter choose two different outcomes: sporulation or competence. This leads us to speculate whether similar ideas can be extrapolated to explain the decisions of cells to develop cancer: Can a similar cell in a tissue make the decision to duplicate normally or to modify into a cancer cell? How does this stochastic process affect life, biology, evolution and disease is an interesting challenge that will be at the center of questions answered at the interface of the physical and life sciences."

Story Source:

Adapted from materials provided by University of California - San Diego.

http://www.sciencedaily.com/releases/2009/12/091211200341.htm

Understanding Ocean Climate



Ocean temperature at the 100 m depth and sea ice thickness in Sept. 2006 from the 8 km resolution global model. (Credit: NOCS)

ScienceDaily (Dec. 13, 2009) — High-resolution computer simulations performed by scientists at the National Oceanography Centre, Southampton (NOCS) are helping to understand the inflow of North Atlantic water to the Arctic Ocean and how this influences ocean climate.

The summer of 2007 saw a record retreat in Arctic sea ice, and in general Arctic climate has become steadily warmer since the early 1990s. This has changed both sea ice drift and upper ocean circulation.

The warm North Atlantic water intrudes into the central Arctic Ocean through Fram Strait, the deep channel between Greenland and Spitsbergen that connects the Nordic Seas to the Arctic Ocean, contributing to sea ice melting.

"We need to understand what is going on because changes in the Arctic Ocean can influence climate around the world," said Dr Yevgeny Aksenov of NOCS: "The worry is that freshwater from melting ice and increased atmospheric precipitation in the Arctic could ultimately slow the overturning circulation of the North Atlantic, with serious consequences for global climate."

The researchers used a high-resolution computer model of ocean and sea ice, taking into account the shape of the seabed, and the affects of ice melting, snow and rainfall, solar radiation, and winds. The simulations were verified using long-term measurements of ocean currents and other key climatological and oceanographical data.

"Computers are now powerful enough to run multi-decadal global simulations at high resolution," said Dr Aksenov: "This helps to understand how the ocean is changing and to plan observational programmes so as to make measurements at sea more efficient."

The researchers find that between 1989 and 2009, about half of the salty North Atlantic water entering the Arctic Ocean came through Fram Strait, and half through the Barents Sea, north of Norway and Russia. However, most of the heat entered the Arctic Ocean through Fram Strait.

Based on their simulations and available observations, they propose a new scheme for the inflow of North Atlantic water into the Arctic Ocean, involving three main routes.

The first delivers warm saline water to the Arctic Ocean through Fram Strait. The other two bring cooled and freshened North Atlantic water to the Arctic Ocean via the Barents Sea.

A northern branch delivers water from the western Barents Sea, mixed to some extent with the Fram Strait branch. Here, North Atlantic water interacts with Arctic waters, resulting in fresh, cold water overlying saltier water below the mixed layer at a depth of around 50-170 metres.

The southern branch supplies the Arctic Ocean with warmer and more saline bottom water formed in the southeastern Barents Sea via full-depth convection and mixing.

Both the northern and southern branches of the Barents Sea flow deliver North Atlantic water to the Arctic Ocean via the 620 metre deep St Anna's Trough, located east of the Franz Josef archipelago in the far north of Russia. Together they transport around one and a half million cubic metres of water a second.

"Our research is leading to a physically based picture, our eventual goal being a comprehensive understanding of the mechanisms driving ocean climate change," said Dr Aksenov.

The research was supported by the RAPID Climate Change Programme and Arctic Synoptic Basin-wide Oceanography Consortium, Natural Environment Research Council, UK.

The researchers are Yevgeny Aksenov, Sheldon Bacon, Andrew Coward and George Nurser (all of NOCS).

Story Source:

Adapted from materials provided by National Oceanography Centre, Southampton (UK).

Journal Reference:

1. Aksenov et al. **The North Atlantic inflow to the Arctic Ocean: High-resolution model study**. *Journal of Marine Systems*, 2010; 79 (1-2): 1 DOI: 10.1016/j.jmarsys.2009.05.003

http://www.sciencedaily.com/releases/2009/12/091210101410.htm

Absorbing Hydrogen Fluoride Gas to Enhance Crystal Growth

Vyacheslav Solovyov (left) and Harold "Bud" Wiesmann. (Credit: Image courtesy of DOE/Brookhaven National Laboratory)

ScienceDaily (Dec. 13, 2009) — Two scientists at the U.S. Department of Energy's (DOE) Brookhaven National Laboratory have developed a method to control the buildup of hydrogen fluoride gas during the growth of precision crystals needed for applications such as superconductors, optical devices, and microelectronics. The invention -- by Vyacheslav Solovyov and Harold Wiesmann and recently awarded U.S. Patent number 7,622,426 -- could lead to more efficient production and improved performance of these materials.

Materials with highly ordered crystalline atomic structures have enormous potential for energy-saving devices such as superconductors, which carry current with no energy loss, and high-speed electronics. Such crystals are typically grown from precursors deposited on substrates -- for example: tapes, wires, or wafers, such as those used in the production of computer chips.

Adding fluorine to the precursors enhances the transfer of crystalline order from the substrate to the growing material. But fluorine also presents a problem because it leads to the buildup of hydrogen fluoride gas. Hydrogen fluoride slows down the reaction that converts the precursor to the desired material, sometimes even stopping crystal growth in its tracks.

"You might think you could just vent the accumulating gas, but such methods have proven impractical," said Wiesmann. For one thing, you'd have to remove the gas uniformly, to avoid variations in pressure that might affect crystal growth, which becomes more difficult over larger areas. Also, other gases

necessary to crystal growth, such as oxygen and water vapor, get extracted along with the hydrogen fluoride, and re-injecting these gases introduces more pressure problems.

"We've developed an improved method for removing hydrogen fluoride, based on absorption, that enhances the production of high-quality crystalline products." Wiesmann said.

The new method incorporates a solid material capable of absorbing hydrogen fluoride (HF) gas inside the reaction chamber. The solid material can be attached to the inner surface of the reaction chamber or free standing, as long as it is made to conform to the shape of the precursor at a uniform distance. This allows uniform extraction of HF across large areas, thereby yielding crystalline end products that are uniform and homogeneous regardless of the shape of the precursor material or the area it occupies inside the reaction chamber.

A wide range of materials from alkaline earth oxides to materials containing calcium, sodium, or even activated carbon can be used as HF absorbers. The HF absorber material could be sprayed, painted, or otherwise deposited onto an inert support such as quartz or various oxides to attach it to the reaction chamber. Or it could be made from a powder and pressed into a form that conforms to the shape of the growing crystals.

"Because these materials selectively absorb HF gas, water vapor, oxygen, and other gases that may be present and necessary for the conversion of the precursor material to finished crystals remain in the reaction vessel, undisturbed," Solovyov said.

Solovyov and Wiesmann demonstrated the effectiveness of this approach when growing crystals of a common yttrium-barium-copper-oxide (YBCO) superconductor. In these experiments, YBCO crystals grew at a faster rate in the presence of a barium-oxide HF absorber when compared to conventional methods of crystal growth. The method also preserves the uniformity of the crystal growth environment so that superconducting properties do not vary along the length of the film.

This specific reaction serves as only one example, and the patent applies to the many possible modifications and variations in the materials used and produced.

The new method is available for licensing and commercial development. For further information about the patent and commerical opportunities, contact Brookhaven Lab licensing specialist Kimberley Elcess, elcess@bnl.gov, 631 344-4151.

The research was funded by DOE's Office of Electricity Delivery and Energy Reliability.

Story Source:

Adapted from materials provided by DOE/Brookhaven National Laboratory.

http://www.sciencedaily.com/releases/2009/12/091210101414.htm

Caffeine Doesn't Reverse the Negative Cognitive Impact of Alcohol, Study Shows

ScienceDaily (Dec. 13, 2009) — People who drink may want to know that coffee won't sober them up, according to new laboratory research. Instead, a cup of coffee may make it harder for people to realize they're drunk.

What's more, popular caffeinated "alcohol-energy" drinks don't neutralize alcohol intoxication, suggest the findings from a mouse study reported in the journal *Behavioral Neuroscience*, which is published by the American Psychological Association.

"The myth about coffee's sobering powers is particularly important to debunk because the co-use of caffeine and alcohol could actually lead to poor decisions with disastrous outcomes," said co-author Thomas Gould, PhD, of Temple University, in extending the research to what it means for humans.

"People who have consumed only alcohol, who feel tired and intoxicated, may be more likely to acknowledge that they are drunk," he added. "Conversely, people who have consumed both alcohol and caffeine may feel awake and competent enough to handle potentially harmful situations, such as driving while intoxicated or placing themselves in dangerous social situations."

In the laboratory, caffeine made mice more alert but did not reverse the learning problems caused by alcohol, including their ability to avoid things they should have known could hurt them, according to the study.

Scientists gave groups of young adult mice various doses, both separately and together, of caffeine and of ethanol (pure alcohol) at levels known to induce intoxication. The doses of caffeine were the equivalent of one up to six or eight cups of coffee for humans. Control mice were given saline solution.

Gould and co-author Danielle Gulick, PhD, then tested three key aspects of behavior: the ability to learn which part of a maze to avoid after exposure to a bright light or loud sound; anxiety, reflected by time spent exploring the maze's open areas; and general locomotion.

Ethanol, as expected, increased locomotion and reduced anxiety and learning in proportion to the dose given. In other words, intoxicated animals were more relaxed and moved around more but learned significantly less well than control mice to avoid the part of the maze with the unpleasant stimuli.

By itself, caffeine increased anxiety and reduced both learning and locomotion. Compared to the control animals, mice given caffeine were significantly more inhibited, less mobile and less savvy about avoiding the unpleasant stimuli.

When the drugs were given together, ethanol blocked caffeine's ability to make the mice more anxious. Conversely, caffeine did not reverse ethanol's negative effect on learning. As a result, alcohol calmed the caffeine jitters, leaving an animal more relaxed but less able to avoid threats -- a combination that the authors speculated could make people more likely to believe they are not drunk or not impaired enough to have problems functioning.

"The alcohol-energy drink combinations have skyrocketed in popularity," Gould noted. He cited other evidence that these drinks produce deficits in general cognitive ability and raise the odds of alcohol-related problems such as drunken-driving citations, sexual misconduct, and needing medical assistance.

"The bottom line is that, despite the appeal of being able to stay up all night and drink, all evidence points to serious risks associated with caffeine-alcohol combinations," he concluded.

The Food and Drug Administration is looking into the safety and legality of combination alcohol-caffeine beverages. In November, it sent letters to 30 manufacturers asking for evidence that such drinks are safe and legal under FDA regulations.

To date, the FDA has only approved caffeine as an additive in soft drinks at concentrations less than 200 parts per million and has not approved adding caffeine at any level to alcoholic beverages. Under the Federal Food, Drug and Cosmetic Act, a substance added intentionally to food (such as caffeine in alcoholic beverages) is deemed unsafe and is unlawful unless its particular use has been approved by FDA regulation or is generally recognized as safe.

Story Source:

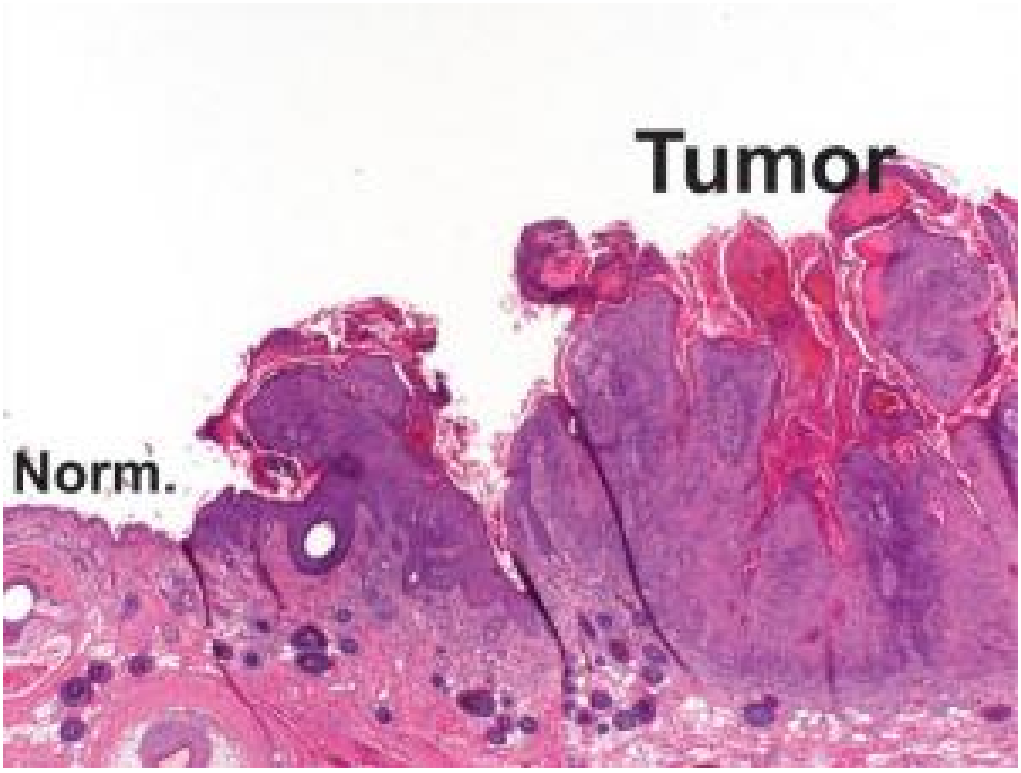
Adapted from materials provided by American Psychological Association, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Danielle Gulick, Thomas J. Gould. **Effects of Ethanol and Caffeine on Behavior in C57BL/6 Mice in the Plus-Maze Discriminative Avoidance Task**. *Behavioral Neuroscience*, 2009; 123 (6)

http://www.sciencedaily.com/releases/2009/12/091207143347.htm

New Model of Skin Cancer Provides Insights on Second-Most Common Type of Cancer



Normal skin (Norm) with adjacent squamous cell carcinoma (Tumor). (Credit: John T. Seykora, MD, PhD, University of Pennsylvania School of Medicine)

ScienceDaily (Dec. 13, 2009) — Scientists at the University of Pennsylvania School of Medicine have developed a new model of skin cancer based on the knowledge that a common cancer-related molecule called Src kinase is activated in human skin-cancer samples.

"Our previous work demonstrated that Src kinases are activated in human squamous cell carcinomas of the skin. We modeled these observations by increasing the expression of the gene *Fyn*, a member of Src family of proteins, in mouse skin," explains senior author John T. Seykora MD, PhD, assistant professor of Dermatology. In addition, prior work by the Seykora lab on a related protein called Srcasm, discovered by him in 2002, suggested that Srcasm may function as an anti-oncogene, a molecule that keeps others in check in order to control cell growth.

In this proof-of-principle study, published this month in *Cancer Research*, the authors found that genetically engineered mice expressing a *K14-Fyn* transgene develop precancerous lesions and invasive squamous cell carcinomas (SCCs) spontaneously in 5 to 8 weeks. Skin SCCs are the second most common form of cancer, with greater than 250,000 cases annually in the US, leading to approximately 2,500 deaths.

This study demonstrates that Fyn is a potent oncogene in skin. When Srcasm levels are raised in the mouse skin cancer model, tumor formation is dramatically inhibited showing that Srcasm functions as an anti-oncogene.

The findings highlight an important relationship between Fyn and Srcasm -- Fyn encourages growth, while Srcasm inhibits it. "When this system malfunctions, it's like stepping on the gas and taking off the brakes on cell growth," explains Seykora. "Adding Srcasm back to the system lowers Fyn levels and restores order."

Analysis of human skin tumor samples confirmed that Srcasm levels are decreased and Src kinase activity is increased. The authors conclude that one potential means of combating skin cancer would be to inhibit Src kinases and/or increase Srcasm levels.

This work may have broader relevance as Src kinases are one of the longest studied oncogenes and are activated in many types of human cancer, including colon and breast cancer. This study provides insight into how Src kinases are activated in human cancers. Further study of this model may provide insights into treating carcinomas that have increased Src kinase activity.

Future work will involve determining how Srcasm levels are decreased in skin tumors to promote cell growth. In addition, topical compounds will be tested using this model to determine if they may be useful in treating skin cancer in people.

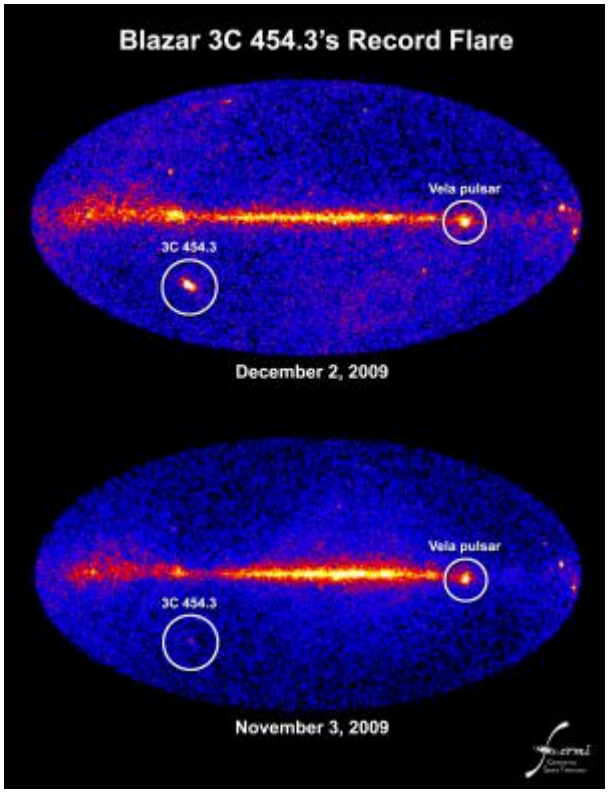
The research was funded by National Institute of Arthritis and Musculoskeletal and Skin Diseases.

Story Source:

Adapted from materials provided by University of Pennsylvania School of Medicine.

http://www.sciencedaily.com/releases/2009/12/091210153651.htm

Brightest-Ever 'Blazar' Flare from Distant Galaxy Spotted by NASA's Fermi Gamma-Ray Space Telescope



Unprecedented flares from the blazar 3C 454.3 in the constellation Pegasus now make it the brightest persistent gamma-ray source in the sky. That title usually goes to the Vela pulsar in our galaxy, which is millions of times closer. These all-sky images, which show the numbers of high-energy gamma-rays captured by Fermi's Large Area Telescope on December 3 and November 18, clearly show the change. (Credit: NASA/DOE/Fermi LAT Collaboration)

ScienceDaily (Dec. 12, 2009) — A galaxy located billions of light-years away is commanding the attention of NASA's Fermi Gamma-ray Space Telescope and astronomers around the globe. Thanks to a series of flares that began September 15, the galaxy is now the brightest source in the gamma-ray sky -- more than ten times brighter than it was in the summer.

Astronomers identify the object as 3C 454.3, an active galaxy located 7.2 billion light-years away in the constellation Pegasus. But even among active galaxies, it's exceptional."We're looking right down the barrel of a particle jet powered by the galaxy's supermassive black hole," said Gino Tosti at the National Institute of Nuclear Physics in Perugia, Italy. "Some change within that jet -- we don't know what -- is likely responsible for these flares."

Blazars, like many active galaxies, emit oppositely directed jets of particles traveling near the speed of light when matter falls toward their central supermassive black holes. What makes a blazar so bright in gamma rays is its orientation: One of the jets happens to be aimed straight at us.Most of the time, the brightest persistent source in the gamma-ray sky is the Vela pulsar, which at a distance of about 1,000 light-years lies practically next door.

"3C 454.3 is millions of times farther away, yet the current flare makes it twice as bright as Vela," said Lise Escande at the Center for Nuclear Studies in Gradignan, near Bordeaux, France. "That represents an incredible energy release, and one the source can't sustain for very long."

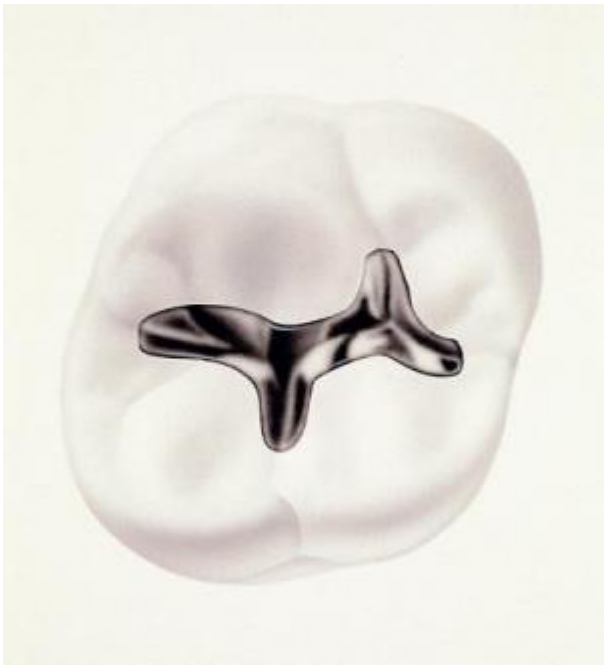
According to Massimo Villata at Italy's Torino Observatory, 3C 454.3 also is flaring at radio and visible wavelengths, if less dramatically. "In red light, the blazar brightened by more than two and a half times to magnitude 13.7, and it is also very bright at high radio frequencies."The Fermi team is alerting astronomers to monitor the event over as broad a range of wavelengths as possible. "That's our best bet for understanding what's going on inside that jet," Tosti said.

Story Source:

Adapted from materials provided by NASA/Goddard Space Flight Center.

http://www.sciencedaily.com/releases/2009/12/091209151440.htm

Older Dental Fillings Contain Form of Mercury Unlikely to Be Toxic, Study Finds



Older mercury-based dental fillings contain a form of mercury that scientists say is unlikely to be toxic. (Credit: American Dental Association)

ScienceDaily (Dec. 12, 2009) — A new study on the surface chemistry of silver-colored, mercury-based dental fillings suggests that the surface forms of mercury may be less toxic than previously thought.

It appears online in ACS' journal *Chemical Research in Toxicology*.

In the study, Graham George and colleagues note that mercury-based fillings, also called amalgams, have been used by dentists to repair teeth for well-over a century. In recent decades their use has become controversial because of concerns about exposure to potentially toxic mercury. However, mercury can potentially exist in several different chemical forms, each with a different toxicity. Prior to this report, little was known about how the chemical forms of mercury in dental amalgam might change over time.

Using a special X-ray technique, the scientists analyzed the surface of freshly prepared metal fillings and compared these with the surface of aged fillings (about 20 years old) from a dental clinic. Fresh fillings contained metallic mercury, which can be toxic. Aged fillings, however, typically contain a form of mercury, called beta-mercuric sulfide or metacinnabar, which is unlikely to be toxic in the body.

The scientists found that the surfaces of metal fillings seem to lose up to 95 percent of their mercury over time. Loss of potentially toxic mercury from amalgam may be due to evaporation, exposure to some kinds of dental hygiene products, exposure to certain foods, or other factors.

The scientists caution that "human exposure to mercury lost from fillings is still of concern."

Story Source:

Adapted from materials provided by American Chemical Society, via EurekAlert!, a service of AAAS.

Journal Reference:

1. George et al. **The Chemical Forms of Mercury in Aged and Fresh Dental Amalgam Surfaces**. *Chemical Research in Toxicology*, 2009; 22 (11): 1761 DOI: 10.1021/tx900309c

http://www.sciencedaily.com/releases/2009/12/091209121206.htm

West Nile Virus Infection May Persist in Kidneys Years After Initial Infection

ScienceDaily (Dec. 12, 2009) — A new study shows that people who have been infected with West Nile virus may have persistent virus in their kidneys for years after initial infection, potentially leading to kidney problems.

The research appears in the January 1 issue of *The Journal of Infectious Diseases*.

Spread by infected mosquitoes, West Nile virus was first detected in the United States in 1999. Since then, approximately 25,000 human cases have been reported, causing more than 1,000 deaths. Many more have become infected without showing symptoms.

Previous animal studies raised the possibility that patients may still be infected with the virus several years after recovering from their initial illness. Prior to this latest research, however, humans were thought to remain infected with West Nile virus only for the first few days of illness.

The study, led by Kristy Murray, DVM, PhD at the University of Texas School of Public Health in Houston, demonstrates that not all individuals clear the virus from their system within the first few days -- and that it can remain in the kidneys for years, potentially leading to kidney failure.

Dr. Murray and her colleagues followed more than 100 patients in Houston with severe initial West Nile virus infections for seven years. Individuals were evaluated and blood samples collected every six months. More than half continued to have infection-related symptoms years after their initial illness, although symptoms began to plateau around two years after infection.

The deaths of five participants due to kidney failure led researchers to consider whether the kidney could be a preferred replication site for the virus.

To test this hypothesis, Dr. Murray and her team collected urine samples from 25 patients from their original cohort and tested them for presence of West Nile virus. In this group, five patients (20 percent) tested positive for the virus. Viral RNA could be detected in the urine for at least six years following infection.

Four of the five patients who tested positive for virus also experienced chronic symptoms. Of these five, one patient developed kidney failure. These results show that West Nile virus is capable of long term persistence in patients, particularly when chronic symptoms are present.

In an accompanying editorial, Ernest Gould, PhD, of the Centre for Ecology and Hydrology in Oxford, England, points out that this study raises the additional concern that West Nile virus and other flaviviruses may be transmitted to mosquitoes by apparently healthy humans or animals. This possibility has the potential to start epidemics in new regions of the world.

According to Dr. Murray, patients who have been infected with West Nile virus should "have their kidneys monitored by their physician for any evidence of disease and be aware that persistent infection of the kidneys can happen." Dr. Murray also reminds the public to take proper precautions to protect themselves from mosquito bites during transmission seasons, typically the summer and fall, to avoid infection.

More research is needed to "understand the underlying mechanisms related to the shedding of virus particles in urine, whether shedding of the virus is constant or intermittent, and whether or not this represents true infection resulting in kidney disease," the investigators say. They continue to evaluate all study participants, particularly in regard to kidney function. In addition, they are focusing on developing treatment options for those who remain infected with the virus.

Fast Facts

- Individuals who have had severe infections with West Nile virus may harbor the virus in their kidneys for many years.
- This study suggests that individuals infected with West Nile virus should have their kidneys monitored for disease and be aware that disease persistence can occur.

Story Source:

Adapted from materials provided by Infectious Diseases Society of America.

Journal Reference:

1. Kristy Murray, Christopher Walker, Emily Herrington, Jessica A. Lewis, Joseph Mccormick, David W. C. Beasley, Robert B. Tesh, Andsusan Fisher%u2010Hoch. **Persistent Infection with West Nile Virus Years after Initial Infection**. *The Journal of Infectious Diseases*, 2010; 201 (1): 2 DOI: 10.1086/648731

http://www.sciencedaily.com/releases/2009/12/091207143355.htm

Lightning-Produced Radiation a Potential Health Concern for Air Travelers

Lightning storm. (Credit: iStockphoto/David Parsons)

ScienceDaily (Dec. 12, 2009) — New information about lightning-emitted X-rays, gamma rays and high-energy electrons during thunderstorms is prompting scientists to raise concerns about the potential for airline passengers and crews to be exposed to harmful levels of radiation.

Scientists at the Florida Institute of Technology, University of California, Santa Cruz and the University of Florida have estimated that airplane passengers could be exposed to a radiation dose equal to that from 400 chest X-rays if their airplane happens to be near the start of a lightning discharge or related phenomena known as a terrestrial gamma ray flash.

The big unknown: how often -- if ever -- commercial airliners are exposed to these thunderstorm events, because the bursts of radiation occur only over extremely brief periods and extend just a few hundred feet in the clouds.

"We know that commercial airplanes are typically struck by lightning once or twice a year," said Joe Dwyer, professor of physics and space sciences at Florida Tech. "What we don't know is how often planes happen to be in just the right place or right time to receive a high radiation dose. We believe it is very rare, but more research is needed to answer the question definitively."

Dwyer is the lead author of a paper about the research set to appear in the *Journal for Geophysical Research -- Atmospheres*. Seven researchers from Florida Tech, UC Santa Cruz and UF contributed to the paper. "Estimation of the fluence of high-energy electron bursts produced by thunderclouds and the resulting radiation doses received in aircraft."

The authors did not measure high radiation doses directly with airplanes. Instead, they estimated radiation based on satellite and ground-based observations of X-rays and gamma rays.

The authors "combined observations of lightning-produced X-rays and gamma rays with computer models of the movement of high-energy particles to estimate the amount of radiation that could be produced within, or very near, thunderclouds during lightning storms," said Hamid Rassoul, a co-author and senior researcher from Florida Tech.

The observations included those made from orbiting satellites of "terrestrial gamma-ray flashes," or TGFs, mysterious phenomena that appear to originate within thunderstorms at the same altitudes used by jet airliners. They also included measurements of X-rays and gamma rays from natural lightning on the ground, as well as artificial lightning triggered with wire-trailing rockets fired into storm clouds. Researchers believe the phenomena are linked, because both produce high levels of gamma rays and X-rays and occur along with the actual lightning flash.

The scientists concluded the radiation in a football field-sized space around these lightning events could reach "biologically significant levels," up to 10 rem, according to their paper.

"If an aircraft happened to be in or near the high-field region when either a lightning discharge or a TGF event is occurring, then the radiation dose received by passengers and crew members inside the aircraft could potentially approach 10 rem in less than one millisecond," the paper says.

Ten rem is considered the maximum safe radiation exposure over a person's lifetime. It is equal to 400 chest X-rays, three CAT scans or 7,500 hours of flight time in normal conditions. All airplane passengers are exposed to slightly elevated radiation levels due to cosmic rays.

While the research raises obvious concerns, the scientists stressed that they don't know how often the high-radiation events occur -- or how often planes are nearby enough to expose passengers and flight crews to potential danger.

David Smith, an associate professor of physics at UC-Santa Cruz, said recent airborne research suggests the incidents are rare. Flying aboard a National Science Foundation/National Center for Atmospheric Research aircraft this past summer in Florida, Smith and several of the other researchers used a highly sophisticated instrument to measure gamma ray flashes from thunderstorms. Over the course of several flights, they were only able to detect one such flash, at a safe distance from the plane.

"These observations show that although thunderstorms do occasionally create intense gamma-ray flashes, the chance of accidently being directly hit by one is small," Smith said.

Martin Uman, another author and a distinguished professor of electrical and computer engineering at UF, noted that airline pilots typically seek to avoid flying through storms.

However, he said, the fact that commercial planes are struck once or twice a year suggests more inquiry is needed. He said he would recommend to the Federal Aviation Administration that it place detectors aboard planes capable of measuring the storm-related, brief and intense radiation bursts to determine how often they occur. He also said more research on the phenomena that generates the bursts is clearly needed.

"What we need to do is supply the right kind of detectors to a lot of planes, and see if this ever happens," he said. "We also need to spend more time looking at gamma and x-ray radiation from lightning and thunderstorms and trying to understand how it works."

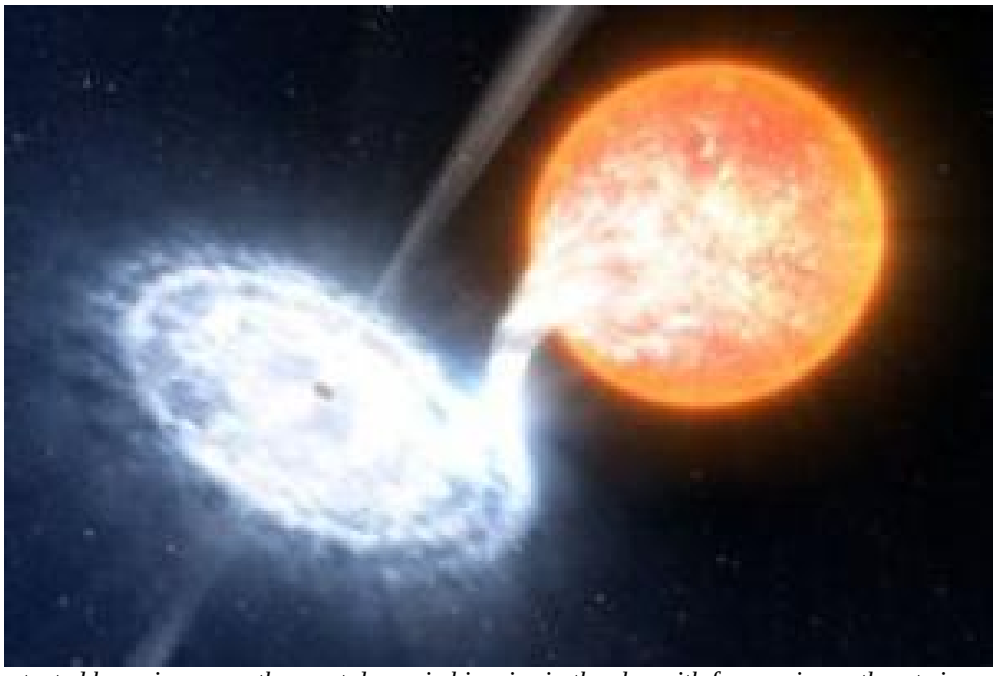
The paper drew on data from numerous observations and experiments, including experiments involving artificial "triggered" lightning at UF/Florida Tech International Center for Lightning Research and Testing at the Camp Blanding Army National Guard Base near Starke, Florida. UF and Florida Tech researchers at the center were the first to identify X-ray emissions from triggered lightning.

Story Source:

Adapted from materials provided by University of Florida.

http://www.sciencedaily.com/releases/2009/12/091207165033.htm

Suzaku Catches Retreat of a Black Hole's Disk



GX 339-4, illustrated here, is among the most dynamic binaries in the sky, with four major outbursts in the past seven years. In the system, an evolved star no more massive than the sun orbits a black hole estimated at 10 solar masses. (Credit: ESO/L. Calçada)

ScienceDaily (Dec. 12, 2009) — Studies of one of the galaxy's most active black-hole binaries reveal a dramatic change that will help scientists better understand how these systems expel fast-moving particle jets.

Binary systems where a normal star is paired with a black hole often produce large swings in X-ray emission and blast jets of gas at speeds exceeding one-third that of light. What fuels this activity is gas pulled from the normal star, which spirals toward the black hole and piles up in a dense accretion disk.

"When a lot of gas is flowing, the dense disk reaches nearly to the black hole," said John Tomsick at the University of California, Berkeley. "But when the flow is reduced, theory predicts that gas close to the black hole heats up, resulting in evaporation of the innermost part of the disk." Never before have astronomers shown an unambiguous signature of this transformation.

To look for this effect, Tomsick and an international group of astronomers targeted GX 339-4, a low-mass X-ray binary located about 26,000 light-years away in the constellation Ara. There, every 1.7 days, an evolved star no more massive than the sun orbits a black hole estimated at 10 solar masses. With four major outbursts in the past seven years, GX 339-4 is among the most dynamic binaries in the sky.

In September 2008, nineteen months after the system's most recent outburst, the team observed GX 339-4 using the orbiting Suzaku X-ray observatory, which is operated jointly by the Japan Aerospace Exploration Agency and NASA. At the same time, the team also observed the system with NASA's Rossi X-ray Timing Explorer satellite.

Instruments on both satellites indicated that the system was faint but in an active state, when black holes are known to produce steady jets. Radio data from the Australia Telescope Compact Array confirmed that GX 339-4's jets were indeed powered up when the satellites observed.

Despite the system's faintness, Suzaku was able to measure a critical X-ray spectral line produced by the fluorescence of iron atoms. "Suzaku's sensitivity to iron emission lines and its ability to measure the shapes of those lines let us see a change in the accretion disk that only happens at low luminosities," said team member Kazutaka Yamaoka at Japan's Aoyama Gakuin University.

X-ray photons emitted from disk regions closest to the black hole naturally experience stronger gravitational effects. The X-rays lose energy and produce a characteristic signal. At its brightest, GX 339-4's X-rays can be traced to within about 20 miles of the black hole. But the Suzaku observations indicate that, at low brightness, the inner edge of the accretion disk retreats as much as 600 miles.

"We see emission only from the densest gas, where lots of iron atoms are producing X-rays, but that emission stops close to the black hole -- the dense disk is gone," explained Philip Kaaret at the University of Iowa. "What's really happening is that, at low accretion rates, the dense inner disk thins into a tenuous but even hotter gas, rather like water turning to steam."

The dense inner disk has a temperature of about 20 million degrees Fahrenheit, but the thin evaporated disk may be more than a thousand times hotter.

The study, which appears in the Dec. 10 issue of The Astrophysical Journal Letters, confirms the presence of low-density accretion flow in these systems. It also shows that GX 339-4 can produce jets even when the densest part of the disk is far from the black hole.

"This doesn't tell us how jets form, but it does tell us that jets can be launched even when the high-density accretion flow is far from the black hole," Tomsick said. "This means that the low-density accretion flow is the most essential ingredient for the formation of a steady jet in a black hole system."

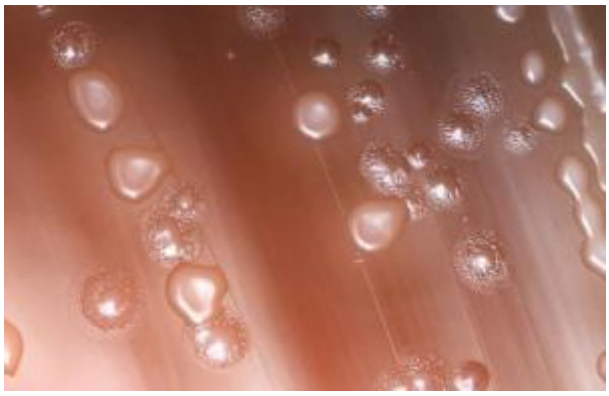
Story Source:

Adapted from materials provided by NASA/Goddard Space Flight Center.

---

http://www.sciencedaily.com/releases/2009/12/091210101416.htm

Fast, Accurate Urine Test for Pneumonia Possible, Study Finds



Streptococcus pneumoniae, growing in this laboratory culture dish, cause community-acquired pneumonia. (Credit: US Centers for Disease Control and Prevention)

ScienceDaily (Dec. 12, 2009) — Doctors may soon be able to quickly and accurately diagnose the cause of pneumonia-like symptoms by examining the chemicals found in a patient's urine, suggests a new study led by UC Davis biochemist Carolyn Slupsky.

Pneumonia is a lung infection that annually sickens millions of people in the United States, resulting in approximately 500,000 hospitalizations and thousands of deaths. A rapid, accurate diagnostic test for pneumonia could save lives by enabling doctors to begin appropriate treatment earlier.

Using technology known as nuclear magnetic resonance spectroscopy, the researchers were able to identify a chemical "fingerprint" for the type of pneumonia caused by the bacterium Streptococcus pneumoniae, and compare this to the chemical fingerprints for other types of pneumonia and noninfectious lung diseases.

Findings from the study, conducted by Slupsky and colleagues in Canada and Australia, are discussed in a research profile in the December issue of the *Journal of Proteome Research*. A patent is pending on the diagnostic procedure.

"This is the first study to demonstrate that NMR-based analysis of metabolites in urine has the potential to provide rapid diagnosis of the cause of pneumonia," said Slupsky, an assistant professor in UC Davis' departments of Nutrition, and Food Science and Technology. She is also a faculty member in UC Davis' Foods for Health Institute.

"It also shows that we can use this technology to quickly and easily monitor patient recovery," Slupsky said. "The goal is a tool for rapid, accurate diagnosis so that patients can quickly begin treatment with the appropriate medication."

Currently, pneumonia is diagnosed by a combination of clinical symptoms, X-rays and analysis of a patient's blood or sputum by bacterial culture. Such tests usually take more than 36 hours to complete and tend to yield a high rate of false-positive results. Previous studies have shown that more than 80 percent of patients admitted to the hospital with pneumonia are misdiagnosed, leading to delays in treatment with the appropriate antibiotic.

About pneumonia

Pneumonia is an infection of the lower respiratory tract that causes symptoms such as difficulty in breathing, fever, chest pains and cough. It can be caused by bacteria, viruses, fungi and parasites, and is difficult to diagnose because other noninfectious ailments can mimic pneumonia.

Streptococcus pneumonia is the major cause of community-acquired, rather than hospital-acquired, pneumonia. It can become life threatening in anyone, but is particularly worrisome in elderly patients, smokers and people with weakened immune systems or chronic lung diseases.

Metabolomics study

In the new study, Slupsky and colleagues applied "metabolomics" -- the study of the chemicals produced by the body's metabolic processes -- to develop a profile for pneumonia as it appears in a patient's urine.

To do this, they analyzed hundreds of urine samples collected from both healthy individuals and patients with a variety of pulmonary diseases or infections. In the process, they measured 61 metabolites in urine samples using NMR spectroscopy.

They found that urine from patients infected with pneumonia caused by Streptococcus pneumoniae had a telltale chemical profile that clearly distinguished those people from healthy individuals or patients with other ailments.

"By analyzing urine samples collected at various intervals during the patient's hospitalization, we could actually observe sick patients recover because their recovery was reflected in the chemical composition of their urine," Slupsky said.

She noted that the research team was surprised to find that most of the changes in metabolites related to infection by Streptococcus pneumoniae were caused by the body's response to the infection rather than by the invading bacteria.

"In future studies, we hope to explore how bacteria and other microbes interact with the body of the individual they infect, and how these interactions alter metabolism in the body, resulting in unique metabolite profiles in the urine," she said.

Slupsky conducted this research while at the University of Alberta. She joined UC Davis in July 2008. Her research focuses on interactions between the human body and bacteria, as they relate to health and disease conditions.

She collaborated on the study with researchers at the University of Alberta, University of Toronto and Austin Health in Australia.

Funding for the study was provided by the Alberta Heritage Foundation for Medical Research, the Lung Association of Alberta and the Northwest Territories, Western Economic Development, and Alberta Advanced Education and Technology.

Story Source:

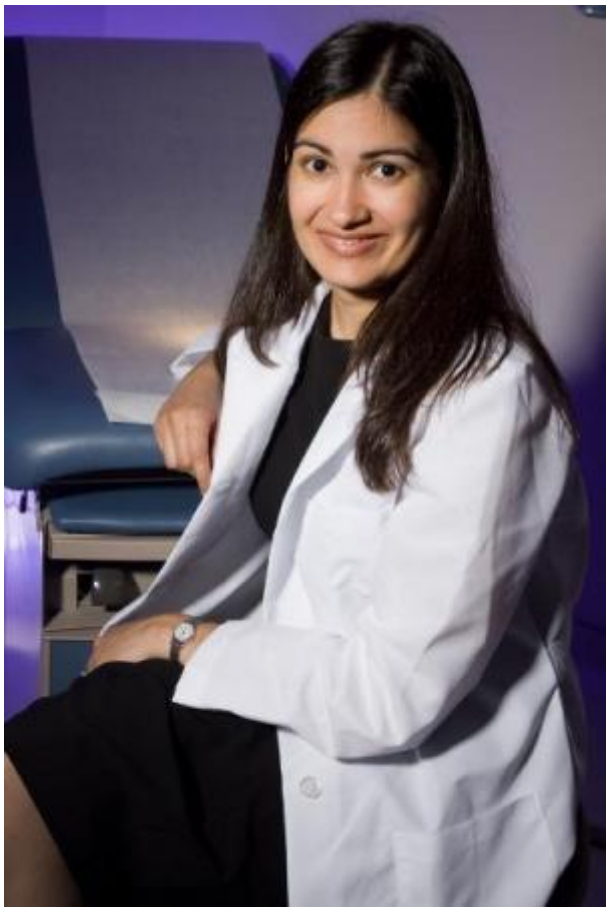
Adapted from materials provided by University of California - Davis.

Journal Reference:

1. Slupsky et al. **Pneumococcal Pneumonia: Potential for Diagnosis through a Urinary Metabolic Profile**. *Journal of Proteome Research*, 2009; 8 (12): 5550 DOI: 10.1021/pr9006427

http://www.sciencedaily.com/releases/2009/12/091209093119.htm

Women Researchers Less Likely to Receive Major Career Funding Grants, Study Shows



Reshma Jagsi, M.D., D.Phil., is an assistant professor of radiation oncology at the University of Michigan Medical School. (Credit: University of Michigan Health System)

ScienceDaily (Dec. 12, 2009) — Women were less likely than men to receive major funding for scientific research, according to a study from the University of Michigan Health System. The study also found that only a quarter of all researchers, both men and women, who received a major early career award went on to get further federal funding within five years.

The study looked at 2,783 researchers who received the highly competitive early career awards called K08 or K23. These awards provide funding that protects a researcher's time and include a mentoring component to help nurture a young clinician-scientist's career. The funding is typically for three to five years.

The researchers then matched the K award recipients to those who were awarded an R01, a prestigious federal grant that is a milestone in a researcher's career.

They found that within five years of a K08 or K23 award, only 23 percent of all researchers had attained an R01. But while 25 percent of men had been awarded an R01, only 19 percent of women had. After 10 years, fewer than half of all K awardees had an R01: 36 percent of women and 46 percent of men.

Results appear in the Dec. 1 issue of *Annals of Internal Medicine*.

"It's concerning that the whole group is not succeeding at a higher rate, and it is especially concerning that the women are doing even worse than the men," says lead study author Reshma Jagsi, M.D., D.Phil., assistant professor of radiation oncology at the U-M Medical School.

"The K08 and K23 grants are highly competitive, prestigious awards that are supposed to help young scientists become independent investigators. People who get these awards are expected to be the best and the brightest, and they are expected to succeed. They not only have the aptitude for and commitment to research, but the grant is supposed to give them the resources they need -- protected time and mentorship," Jagsi adds.

The authors suggest that family demands, including childbirth, could pull some women scientists from their careers. Women may also be more likely to feel pressures to contribute to the clinical workload and be less successful at negotiating with their department chairs for adequate time to devote to research.

The authors also say some of the fall-off between a K award and an R01 may occur as researchers choose other career paths, such as leadership or administrative roles. They believe further research is necessary to understand how to retain promising young physicians in research careers.

"We in academic medicine need to work harder to help promising young researchers succeed," says senior study author Peter Ubel, M.D., professor of internal medicine and director of the Center for Behavioral and Decision Sciences in Medicine at the U-M Medical School.

"Research takes time and energy, and when young researchers are trying to balance work and family, the major breakthroughs might have to wait a few extra years. New researchers not only need time, they need mentorship. And they need department chairs who understand that scientific success does not require researchers committing every aspect of their lives to their science," Ubel adds.

The study authors urge strengthening the mentoring component of the K awards and considering an increase to the award amounts.

"We as a society have invested critical resources in these individuals. Our findings suggest dysfunction in the pipeline of physician-scientists," Jagsi says. "This is not an easy career path for anyone, and it may be particularly hard for women. We need to figure out how to make this a more tenable career path, and right now both men and women seem to need additional support."

Additional authors: Amy Motomura, Kent Griffith, Soumya Rangarajan, all from U-M

Funding: Joan F. Giambalvo Memorial Fund from the American Medical Association Women Physicians Congress

Story Source:

Adapted from materials provided by University of Michigan Health System, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2009/11/091130192913.htm

UK warns on 'acidifying oceans'
By Richard Black
Environment correspondent, BBC News website, Copenhagen

Acidification of the oceans is a major threat to marine life and humanity's food supply, Hilary Benn has warned as the UN climate summit resumes.

The UK environment secretary said that acidification provided a "powerful incentive" to cut carbon emissions.

Ocean chemistry is changing because water absorbs extra CO2 from the air. Some believe this impact of rising CO2 levels could be as significant as climatic change, though it is rarely discussed at the UN climate convention.

The UN summit in Copenhagen, which started a week ago, is scheduled to conclude on Friday, when more than 100 world leaders will attend in an effort to agree a new global treaty on climate change.

'Really important'

OCEAN ACIDIFICATION
- Up to 50% of the CO2 released by burning fossil fuels over the past 200 years has been absorbed by the world's oceans
- This has lowered the pH value of seawater - the measure of acidity and alkalinity - by 0.1
- The vast majority of liquids lie between pH 0 (very acidic) and pH 14 (very alkaline); 7 is neutral
- Seawater is mildly alkaline with a "natural" pH of about 8.2
- The IPCC forecasts that ocean pH will fall by "between 0.14 and 0.35 units over the 21st Century, adding to the present fall of 0.1 units since pre-industrial times"

The science has come to prominence only within the last five or six years, and most of the details were not available when the convention was signed in 1992.

"We know that the increasing concentration of CO2 [in the air] is making the oceans more acidic," Mr Benn told BBC News.

"It affects marine life, it affects coral, and that in turn could affect the amount of fish in the sea - and a billion people in the world depend on fish for their principal source of protein.

"It doesn't get as much attention as the other problems; it is really important."

In September, the UN-backed study into

(Teeb) concluded that the widely-endorsed target of trying to stabilise atmospheric concentrations of CO2 or their equivalent to around 450 parts per million (ppm) would prove lethal to much of the world's coral. **1.** Up to one half of the carbon dioxide (CO2) released by burning fossil fuels over the past 200 years has been absorbed by the world's oceans **2.** Absorbed CO2 in seawater (H2O) forms carbonic acid (H2CO3), lowering the water's pH level and making it more acidic **3.** This raises the hydrogen ion concentration in the water, and limits organisms' access to carbonate ions, which are needed to form hard parts

Mr Benn made his speech during the summit's "oceans day" at a meeting organised by Stanford University and Scripps Institution of Oceanography, both based in California.

"Unlike global warming, which can manifest itself in nuanced, complex ways, the science of ocean acidification is unambiguous," said Andrew Dickson, a Scripps professor of marine chemistry.

"The chemical reactions that take place as increasing amounts of carbon dioxide are introduced to seawater have been established for nearly a century."

The oceans and atmosphere are constantly exchanging CO2.

Concentrations in the atmosphere are now about 30% higher than in pre-industrial times; a proportion of this is absorbed by seawater, which results in rising concentrations of carbonic acid.

As a result, the pH of seawater has fallen by about 0.1, and a further change of 0.3-0.4 is expected by the end of the century.

This is likely to affect the capacity of organisms including molluscs, coral and plankton to form "hard parts" of calcium carbonate.

A 2007 study showed that rates of coral growth on the Great Barrier Reef had fallen by 14% since 1990.

Mr Benn said that the Intergovernmental Panel on Climate Change (IPCC) should investigate ocean acidification during its next major assessment of the Earth's climate, scheduled for release in 2013.

The UK's Climate Change Secretary Ed Miliband has warned that the international talks in Copenhagen are not on track to deliver the ambitious agreement some are pushing for.

With world leaders arriving at the talks in Copenhagen later in the week, the pressure is on negotiators to come up with a political agreement that heads of state and government can sign up to.

Mr Miliband said not enough progress was being made in efforts to secure a deal to cut greenhouse gas emissions and provide funding to poor countries for development and adaptation to climate change.

Richard.Black-INTERNET@bbc.co.uk

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8411135.stm

Published: 2009/12/14 12:04:37 GMT

Genetic 'map' of Asia's diversity

An international scientific effort has revealed the genetics behind Asia's diversity.

The Human Genome Organisation's (HUGO) Pan-Asian SNP Consortium carried out a study of almost 2,000 people across the continent. Their findings support the hypothesis that Asia was populated primarily through a single migration event from the south.

The researchers described their findings in the journal Science. They found genetic similarities between populations throughout Asia and an increase in genetic diversity from northern to southern latitudes.

The team screened genetic samples from 73 Asian populations for more than 50,000 single-nucleotide polymorphisms (SNPs). These are variations in pieces of the DNA code, which can be compared to find out how closely related two individuals are genetically.

" **This is the first study to give a clear answer to the question on the origin of East Asian populations** "
Shuhua Xu Chinese Academy of Sciences

The study found that, as expected, individuals who were from the same region, or who shared a common language also had a great deal in common genetically. But it also answered a question about the origin of Asia's population. It showed that the continent was likely populated primarily through a single migration event from the south.

Previously, there has been some debate about whether Asia was populated in two waves - one to South East Asia, and a later one to central and north-east Asia, or whether only a single migration occurred.

Diversity explained

Edison Liu from the Genome Institute of Singapore was a leading member of the consortium.

He explained that the age of a population has a much bigger effect on genetic diversity than the population size.

"It seems likely from our data that they entered South East Asia first - making these populations older [and therefore more diverse]," he said.

"[It continued] later and probably more slowly to the north, with diversity being lost along the way in these 'younger' populations.

"So although the Chinese population is very large, it has less variation than the smaller number of individuals living in South East Asia, because the Chinese expansion occurred very recently, following the development of rice agriculture - within only the last 10,000 years."

Dr Liu said that it was "good news" that populations throughout Asia are genetically similar.

This knowledge will aid future genetic studies in the continent and help in the design of medicines to treat diseases that Asian populations might be at a higher risk of.

And the discovery of this common genetic heritage, he added, was a "reassuring social message", that "robbed racism of much biological support".

" **This provides another important piece to the jigsaw puzzle of global human diversity** "
Peter Underhill, Stanford University

Shuhua Xu from the Chinese Academy of Sciences, who was a member of the consortium, said that this was "the first comprehensive study of genetic diversity and history of Asian populations".

"This is the first study to give a clear answer to the question on the origin of East Asian populations," Dr Xu added.

Vincent Macaulay, a statistical geneticist at the University of Glasgow in the UK told Science magazine that the team had produced "a fabulous data set".

The evidence for the southern coastal migration route, he said seemed "very strong".

The consortium involved 90 scientists from 11 countries including China, India, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand and the US.

Peter Underhill, a geneticist from Stanford University who was not involved in this study said that it represented an investment of a "tremendous amount of time, work and inter-institution collaboration".

He told BBC News: "This provides another important piece to the jigsaw puzzle of global human diversity."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8406506.stm

Published: 2009/12/11 15:38:27 GMT

Volume turned down on MP3 players

The European Commission is calling for a suggested maximum volume to be set on MP3 players, to protect users' hearing.

The commission wants all MP3 players sold in the EU, including iPods, to share the same volume limits.

This follows a report last year warning that up to 10m people in the EU face permanent hearing loss from listening to loud music for prolonged periods.

EU experts want the default maximum setting to be 85 decibels, according to BBC One's Politics Show.

Users would be able to override this setting to reach a top limit of 100 decibels.

In January, a two-month consultation of all EU standardisation bodies will begin on these proposals, with a final agreement expected in the spring.

Some personal players examined in testing facilities have been found to reach 120 decibels, the equivalent of a jet taking off, and no safety default level currently applies, although manufacturers are obliged to print information about risks in the instruction manuals.

Modern personal players are seen as more dangerous than stationary players or old-fashioned cassette or disk players because they can store hours of music and are often listened to while in traffic with the volume very high to drown out outside noise.

Dr Robin Yeoh, an audiology consultant at the Epsom and St Helier NHS Trust, said: "More and more young people are referred to me by their GPs with tinnitus or hearing loss as a direct result to exposure to loud music.

"It's the sort of damage that in the old days would have come from industrial noise.

"The damage is permanent and will often play havoc with their employment opportunities and their personal lives."

'Personal choice'

DigitalEurope, the Brussels-based body representing the industry, agrees safety must be improved.

But according to their spokesman Tony Graziano, "the solution must lie in a balance between safety and enjoyment of the product by the consumer".

"Eighty five decibels would not be appropriate because noise coming from traffic, engines and so on would obliterate the sound," he said.

Conservative MEP Martin Callanan, who sits on the European Parliament's Environment, Public Health and Food Safety Committee, said: "Kids have always listened to their music loud and this is not going to stop them."

He added: "You have to educate them to the risks but ultimately you have to allow personal responsibility and personal choice."

The Politics Show broadcasts at 1200 GMT on BBC One and for seven days after on the BBC

Here's a selection of some of the comments BBC News readers have sent to us about this story.

I think that is a very good idea, this would help teens a lot as they would protect them from hearing loud music. Hope this becomes a law here in the US . ***John Estrada Serpa, York, Pennsylvania, USA***

My MP3 player can get very loud, and like those very unfortunate people, i'm left with loud intrusive tinnitus. Due to my own neglect, I now struggle to sleep every night, and silence is a dream now.

I am always telling my younger sister to turn down her mp3 player, she listens to it very loud, like I used to. ***Aron Roy, Utah***

The quality of headphones plays a huge part in this and not just the volume capability of the player itself. Typically the headphones that come as standard are cheap low quality that do not fit the ears correctly.

Consumers then have to increase volumes on the player to replicate what the track should sound like and drown out background noise. Noise cancelling headphones clearly help here and the manufacturers should invest a little more here.

This will not only help the issue in question but will promote the overall quality of the product being provided in the form of the sound quality. ***Mark Redfern, Shepperton, Middlesex***

I believe that the reason people listen to their music so loud is because of the outside noise. If a player has an artificial limit for volume levels, it should also have quality noise-cancelling headphones.

I myself don't listen to music that requires loud volume, but it does disturb me when I can hear lyrics coming from somebody's headphones on the other end of the bus. ***Shoji Hitachi, Finland***

I am in favour of maximum noise limits for the user, but feel much more strongly about noise leakage, which is a real annoyance, especially on trains and buses.

It should be illegal to manufacture earphones which leak noise to annoy other people. Lots do not do this, why are any allowed to? ***Stephen , Norwich UK***

This is ridiculous. People should be able to play their music at whatever volume they want, and it is up to them to deal with the consequences of playing it too loud. ***Izaac Solts, Leeds***

I have a conductive hearing loss at the age of 25 years. This is from a natural condition that I have developed rather than a loss from noise etc. However I now wear hearing aids as my loss is around 60db in both ears, however the way the hearing aids are I can't put mp3 player headphones in my ears with them in. So when listening to music I take them out and listen with them.

If my MP3 player was limited to 85 db and I can't hear noise below 60db then I would only be able to hear noise at the equivalent to 25db. This wouldn't allow me normal enjoyment. I would then have to fork out more money to buy an amp, which wouldn't be portable enough to take my mp3 player out with me.

If the EU imposes these limits it would be indirect discrimination towards those with a hearing loss. Those with normal hearing should no the risks. They listen to their music loud by choice. Living in this nanny EU state is taking away our own freedom.

What do you think? In considering my case, would this be worth while? Are the EU going to buy me an amp once MP3 players are restricted to 100db? ***Steven Bailey, Manchester***

In my opinion, the problem lies in a complete lack of noise rejection from the earpieces. If noise from outside were to be mitigated, then users wouldn't feel the need to turn the volume up so high. Closed back headphones are excellent at this. ***Dave, Cornwall***

I purchased a pair if in ear headphones which act like an ear plug, the result is I can play my music much quieter as background noise is blocked. ***Mr Ralph Jolly, Oxford***

I travel on the London Underground every day and quite often I get someone sat next to me with their iPod that it's painful for me to listen to and that can't be good for their hearing. I certainly wouldn't ask them to turn it down, you never know how they are going to react! ***Paul Balaam, London***

My ears were starting to hurt so I bought a pair of noise cancelling headphones which make a massive difference to the volume that you need to listen to music at, especially in traffic. ***Sarah, Ireland***

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/uk_news/politics/8410302.stm

Published: 2009/12/13 09:45:36 GMT

Autism limit on 'self-awareness'

Scientists have produced evidence that self-awareness is a big problem for people with autism.

Sophisticated scans showed the brains of people with autism are less active when engaged in self-reflective thought.

The findings provide a neurological insight into why people with autism tend to struggle in social situations.

The study, by the University of Cambridge, appears in the journal Brain.

" **Navigating social interactions with others requires keeping track of the relationship between oneself and others** "
Michael Lombardo University of Cambridge

Autism has long been considered a condition of extreme egocentrism.

But research has shown the problem is people with the condition have trouble thinking about, and making sense of, themselves.

The researchers used functional magnetic resonance scans to measure brain activity in 66 male volunteers, half of whom had been diagnosed with an autistic spectrum disorder.

The volunteers were asked to make judgements either about their own thoughts, opinions, preferences, or physical characteristics, or about someone else's, in this case the Queen.

By scanning the volunteers' brains as they responded to these questions, the researchers were able to visualise differences in brain activity between those with and without autism.

They were particularly interested in part of the brain called the ventromedial pre-frontal cortex (vMPFC) - known to be active when people think about themselves.

The researchers found this area of the brain was more active when typical volunteers were asked questions about themselves compared with when they were thinking about the Queen.

However, in autism this brain region responded equally, irrespective of whether they were thinking about themselves or the Queen.

Researcher Michael Lombardo said the study showed that the autistic brain struggled to to process information about the self.

He said: "Navigating social interactions with others requires keeping track of the relationship between oneself and others.

"In some social situations it is important to notice that 'I am similar to you', while in other situations it might be important to notice that 'I am different to you'.

"The atypical way the autistic brain treats self-relevant information as equivalent to information about others could derail a child's social development, particularly in understanding how they relate to the social world around them."

Dr. Gina Gómez de la Cuesta, of the National Autistic Society, described the study as "interesting".

"We know many people with autism do want to interact with others and make friends but have difficulty recognising or understanding other people's thoughts and feelings.

"This research has shown that people with autism may also have difficulty understanding their own thoughts and feelings and the brain mechanisms underlying this."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8407857.stm

Published: 2009/12/14 00:04:14 GMT

Body clock link to heart disease

Scientists have raised the possibility that cardiovascular disease is linked to disturbances in the body's 24-hour clock.

Working on mice, the Japanese team found a genetic risk factor for a form of high blood pressure is influenced by 24-hour or circadian rhythms.

The study appears online in the journal Nature Medicine.

Malfunctions in the body clock - which influences much of the body's chemistry - have been linked to many diseases.

" **We know that there is a strong correlation between time of day and cardiovascular events which often coincide with the early morning surge in blood pressure** "
Professor Bryan Williams University of Leicester

And lead researcher Professor Hitoshi Okamura said the latest study was in line with data which suggested shift workers, long-distance flight crews and people with sleep disorders have a heightened risk of heart problems.

High blood pressure - known as hypertension - can lead to heart attack, stroke, kidney damage, and many other medical problems.

Many genes have been identified as being essential elements making up the circadian clock.

For example, mice lacking a pair of molecules known as cryptochromes have an abnormal circadian rhythm.

The latest study, by Kyoto University, found these mice were vulnerable to high blood pressure because of abnormally high levels of a hormone called aldosterone that prompts water retention in the kidneys.

Strong correlation

The researchers showed that the circadian clock directly controls a gene that plays a key role in production of the hormone.

The researchers say a similar gene is found in humans.

They stress more work is needed to determine whether a misfiring circadian clock can lead to high blood pressure in humans.

But Professor Okamura said the research raised the prospect of new ways to treat hypertension.

Professor Bryan Williams, an expert in hypertension at the University of Leicester, described the study as "fascinating".

He said: "We know that there is a strong correlation between time of day and cardiovascular events, which often coincide with the early morning surge in blood pressure.

"So this does provide some insights into the mechanism that might underpin blood pressure deregulation in some people."

Professor Williams said some people with high blood pressure were known to have high levels of aldosterone.

But he added: "What we don't know is how common this mutation might be in human hypertension."

Professor Jeremy Pearson, associate medical director at the British Heart Foundation, said: "Hypertension is common, but the genes controlling blood pressure are not well understood.

"Their identification will help design better treatments for high blood pressure."

But he also stressed more research was needed before it became clear whether the study had identified a potential target for new treatments.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8404097.stm

Published: 2009/12/13 19:00:14 GMT

Exercise 'no aid' for period pain
Emma Wilkinson
Health reporter, BBC News

Exercise does not help to alleviate period pain, despite it being commonly recommended for women with monthly symptoms, say researchers.

A study of more than 650 university students reported in BJOG found 28% had moderate to severe period pain.

But Birmingham University researchers said they found no link with the amount of exercise the participants did.

GPs said women should be encouraged to do exercise regardless but drugs are available for those with period pain.

The study authors said beliefs about exercise being an effective treatment for bad period pain had persisted for years.

" **It is a common problem and people usually self-medicate** "
Professor Steve Field, Royal College of GPs

They carried out a questionnaire among 18 to 25-year-olds to find out what age they started their period, how often they had periods, what contraception they used, and whether they had children or had any conditions such as endometriosis or fibroids.

The students were also asked what type of exercise they did and how often as well as other general lifestyle questions.

Responses showed that 72% had no or very little period pain but 28% had moderate to severe pain with their monthly cycle.

After taking into account mood, ethnicity, weight, smoking, and use of the contraceptive pill, they found no link with how much exercise a woman did and whether she suffered from period pain, or how bad her pain was.

'Anecdotal beliefs'

Researcher, Dr Amanda Daley concluded that more research was needed before women are told that exercise will reduce of alleviate period pain.

"Anecdotal beliefs that exercise is an effective treatment have prevailed for many years and while it might seem intuitively appealing to promote exercise as a treatment for menstrual disorders, the findings from this study, along with many others, would not support such a view.

"Of course there are many other important health reasons for encouraging women to be physically active and exercise performed in moderation is unlikely to be harmful."

Royal College of GPs chairman Professor Steve Field said women with period pain should do what works for them and exercise might make them feel better in general.

"It is a common problem and people usually self-medicate.

"Some exercise is good for you of course but the main treatment for period pain is the contraceptive pill."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8408651.stm

Published: 2009/12/12 00:02:33 GMT

20mph zones 'cut injuries by 40%'

UK cities should have more 20mph speed zones, as they have cut road injuries by over 40% in London, a study claims.

In particular the number of children killed or seriously injured has been halved over the past 15 years, the British Medical Journal reported.

The London School of Hygiene and Tropical Medicine study estimates 20mph zones have the potential to prevent up to 700 casualties in London alone.

At 20mph, it is estimated only one in 40 pedestrians is killed in a crash.

This compares with a one in five chance for someone hit at 30mph.

" **This evidence supports the rationale for 20mph zones not just in major cities in Britain, but also in similar metropolitan areas elsewhere** "
Study leader, Chris Grundy

The researchers compared data on road collisions, injuries and deaths in London between 1986 and 2006, with speed limits on roads.

After adjusting for a general reduction in road injuries in recent years, they found that the introduction of 20mph zones were associated with a 41.9% drop in casualties.

The greatest reduction was seen in children under the age of 11 years and in the numbers of all ages killed or seriously injured.

Cyclist injuries fell by 17% once 20mph zones came in, and injuries in pedestrians have been cut by almost a third.

There was also no evidence of a higher rate of casualties in areas bordering the 20mph zones, as in areas adjacent to 20mph zones casualties fell by an average of 8%.

Expansion

Study leader Dr Chris Grundy, a lecturer at the London School of Hygiene and Tropical Medicine, said: "This evidence supports the rationale for 20mph zones, not just in major cities in Britain, but also in similar metropolitan areas elsewhere.

"Indeed, even within London, there is a case for extending the currently limited provision of such zones to other high casualty roads."

HAVE YOUR SAY The drivers who disobeyed the 30mph limit will still disobey the 20mph limit Asim, Bradford

He estimated that 20mph zones in London save 200 lives a year, but this could increase to 700 if plans to extend the zones were implemented.

A spokesman for the Department of Transport said the study backed their own research showing that 20mph zones help to reduce accidents and casualties.

"Our road safety strategy consultation recommends that local authorities introduce, over time, 20mph zones or limits into streets around schools, and which are primarily residential in nature, to protect pedestrians and cyclists.

"This will save lives and make people feel more secure in walking and cycling on those streets."

Kevin Clinton, head of road safety at the Royal Society for the Prevention of Accidents, said: "This research confirms that one of the most effective ways of protecting vulnerable road users, especially children, is the introduction of 20mph zones.

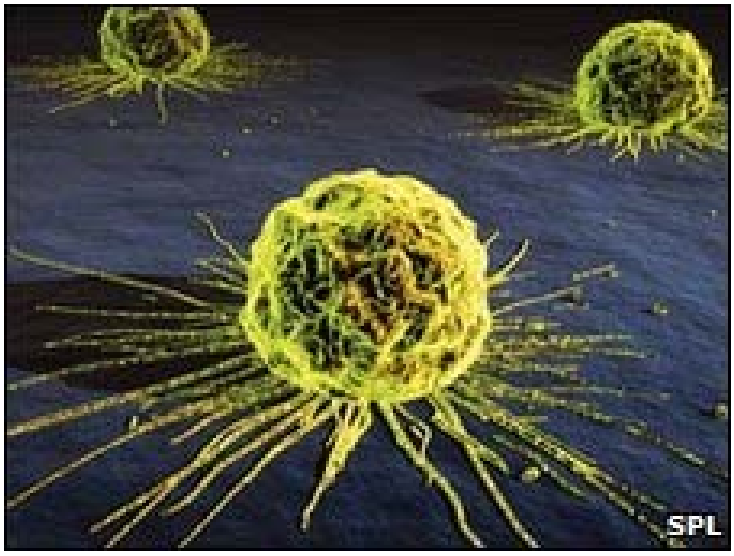
"It lends weight to calls for an expansion of 20mph zones, which RoSPA strongly supports and which we hope will become a crucial part of the new road safety strategy for the next 10 years."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8406569.stm

Published: 2009/12/11 00:03:06 GMT

Alcohol post-breast cancer risk

Women who have had breast cancer should stick to three alcoholic drinks or less a week to reduce the chance of the disease returning, researchers suggest.



A US study of 1,900 women who had recovered from breast cancer found that moderate drinking was linked to a 30% higher risk of recurrence.

The eight-year study found the strongest link in women who were post-menopausal or overweight.

UK charities said alcohol is known to increase the risk of cancer in general.

Presenting the research at the American Association for Cancer Research breast cancer conference, the researchers said few studies had been done on the risk of alcohol consumption and the recurrence of cancer.

" **The good news is that alcohol consumption is something we can change** "
Dr Caitlin Palframan, policy manager, Breakthrough Breast Cancer

The study looked at women diagnosed with breast cancer between 1997 and 2000, and compared recurrence of the disease in those who drank alcohol with those who abstained.

Over the course of the research there were 349 breast cancer recurrences.

The increased risk found in those who drank at least three to four drinks a week was apparent regardless of the type of alcohol drunk.

But alcohol consumption was not associated with overall mortality.

Informed choice

Study leader Dr Marilyn Kwan, from the Kaiser Permanente Division of Research in Oakland, California, said other studies were needed to check the validity of the findings.

But she added: "These results can help women make more informed decisions about lifestyle choices after a diagnosis of breast cancer.

"Women previously diagnosed with breast cancer should consider limiting their consumption of alcohol to less than three drinks per week, especially women who are postmenopausal and overweight or obese."

Dr Caitlin Palframan, policy manager at Breakthrough Breast Cancer, said it would advise women to be aware of how much alcohol they consumed and to drink in moderation.

"We already know that regularly drinking alcohol can increase a woman's chances of developing breast cancer.

"This study may suggest that alcohol consumption could also play a role in the likelihood of the disease coming back.

"The good news is that alcohol consumption is something we can change."

Dr Jodie Moffat, health information manager at Cancer Research UK, said: "It's important to understand the things that influence the odds of breast cancer returning, but as yet we can't say for sure that alcohol plays a part in this.

"We already know that alcohol increases the chances of developing several different types of cancer, including breast cancer - so cutting down on alcohol is certainly an important thing people can do to reduce their cancer risk."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8406273.stm

Published: 2009/12/11 00:03:31 GMT

Ancient Med flood mystery solved
By Victoria Gill
Science reporter, BBC News

Research has revealed details of the catastrophic Zanclean flood that refilled the Mediterranean Sea more than five million years ago.

The flood occurred when Atlantic waters found their way into the cut-off and desiccated Mediterranean basin.

The researchers say that a 200km channel across the Gibraltar strait was carved out by the floodwaters.

Their findings, published in Nature, show that the resulting flood could have filled the basin within two years.

The team was led by Daniel Garcia-Castellanos from the Research Council of Spain (CSIC).

He explained that he and his colleagues laid the foundations for this study by working on tectonic lakes.

" **This... may have involved peak rates of sea level rise in the Mediterranean of more than 10m per day** "
Daniel Garcia-Castellanos Research Council of Spain

They developed a model of how the mountain lakes quickly "cease to exist" when erosion produces "outlet rivers" that drain them.

This same principle, Dr Garcia-Castellanos said, could be used to explain the Zanclean flood that reconnected the Mediterranean with the rest of the World's oceans.

"We could for the first time link the amount of water crossing the channel with the amount of erosion causing it to grow over time," he told BBC News.

New approach

Using existing borehole and seismic data, his team showed how the flood would have begun with water spilling over a sill.

The water would have gradually eroded a channel into the strait, eventually triggering a catastrophic flood, Dr Garcia-Castellanos explained.

He and his colleagues created a computer model to estimate the duration of the flood, and found that, when the "incision channel" reached a critical depth, the water flow sped up.

In a period ranging from a few months to two years, the scientists say that 90% of the water was transferred into the basin.

"This extremely abrupt flood may have involved peak rates of sea level rise in the Mediterranean of more than 10m per day," he and his colleagues wrote in the Nature paper.

Previous estimates of the duration of the flood were very variable, said Dr Garcia-Castellanos, because scientists "had to assume the size of the channel" rather than measure it.

Some estimates suggested that the flood continued for as long as 10,000 years.

Rob Govers, a geoscientist from Utrecht University in the Netherlands, who was not involved in this study, said that the findings were important.

"I think the authors have been very creative using existing data and making sense of it in a completely new way," he said.

Dr Govers said the next important step would be to measure the volume of breccia, or ancient eroded material, in the strait, to confirm whether there was enough material there to have filled the flood channel.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8404363.stm

Published: 2009/12/09 18:05:34 GMT

New drug threat to Asian vultures
By Victoria Gill
Science reporter, BBC News

A veterinary pain drug can be lethal to vultures that eat the carcasses of treated livestock, say scientists.

Ketoprofen is an anti-inflammatory that is used in India to treat cattle.

It had been proposed as a replacement for diclofenac, which scientists say brought some species of Asian vulture to the brink of extinction.

A study published in the Royal Society journal Biology Letters says it causes the birds to suffer acute kidney failure within days of exposure.

This is the same toxic effect caused when vultures feed on the carcasses of animals treated with diclofenac.

Researchers had thought that ketoprofen would be less harmful because it metabolised faster by cows, and converted within hours into a form that is not dangerous to vultures.

But an international team of scientists that carried out safety tests on the drug, found that doses administered to cattle in India were sufficient to kill the birds.

Richard Cuthbert from the Royal Society for the Protection of Birds (RSPB) led the study, which involved researchers from academic institutes and conservation organisations in Europe and Africa.

These included the Bombay Natural History Society, Namibia's Rare and Endangered Species Trust and the University of Pretoria in South Africa.

His team carried out tests on the more common species of vultures, using them a surrogate for endangered Asian vultures.

Their tests showed that meat from animals that had been treated with ketoprofen could be lethal for the birds.

"We also collected samples [of tissue] from cattle carcasses all over India, and analysed them looking for diclofenac and other related drugs," he told BBC News.

"We found carcasses with ketoprofen within them at levels that are likely to cause toxicity."

Safe alternative?

"It's fair to say that ketoprofen is less toxic than diclofenac," said Dr Cuthbert, "and if it's used properly, there probably would be a very low risk to vultures.

"But we know that these drugs are often not used properly, and two or three times the dose is often administered to cattle."

Rhys Green, a zoologist from the University of Cambridge who was not involved in this study, said the findings were important.

"This reveals that a veterinary drug that some pharmaceutical companies in the Indian subcontinent would like to sell more of is not safe for vultures, which have already been reduced to very low levels by diclofenac."

"Ketoprofen isn't a big problem for vultures at the moment because little is used. But it would hamper efforts to restore vulture populations if its level of use increased to rival that of diclofenac."

The RSPB is promoting the use of what it says is now the only safe alternative to diclofenac - a drug called meloxicam.

"We'd like to know of more safe alternatives... and we're asking the Indian pharmacautical industry to step up and test them," said Dr Cuthbert.

The Indian government has banned the production of veterinary diclofenac, but Dr Cuthbert said that there was still a problem with vets using human diclofenac in cattle.

"It's still cheaper than meloxicam," he told BBC News. "But the price of meloxicam is coming down... as more companies produce it."

Professor Green concluded: "There are also other drugs of the same family in use, which have not been tested for their effects on vultures.

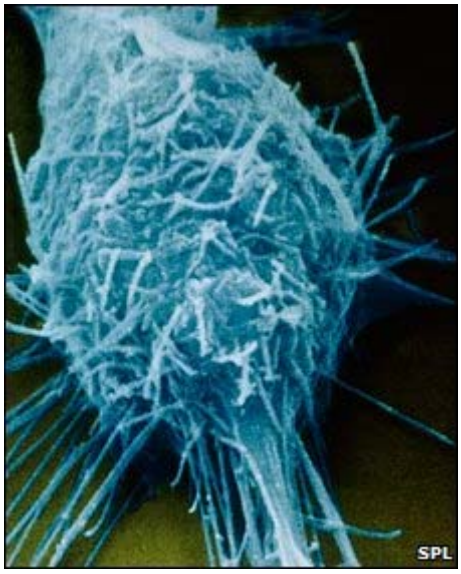
"Testing is expensive and pharmaceutical companies aren't required to do it."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8402464.stm

Published: 2009/12/09 14:17:36 GMT

Major child cancer trial launched

Scientists are to test if boosting the immune system can prevent the return of the childhood cancer neuroblastoma.



The disease - a cancer of developing nervous system tissue - is most often found in under-fives and accounts for about a sixth of child cancer deaths.

The European trial builds on early promising results from a US study which found immunotherapy improved the chances of survival from the disease.

Cancer Research UK is funding the trial for 160 UK children over four years.

The cancer develops in specialised nerve cells, called neural crest cells.

These primitive cells are involved in the development of the nervous system and other tissues.

CASE STUDY
Sophie McGuire developed symptoms soon after her second birthday in January this year. Initially doctors thought she had a virus affecting her hips, but her condition deteriorated - she was constantly tired and lost a lot of weight. After extensive tests she was diagnosed with advanced neuroblastoma in April. Scans showed she had cancerous tissue wrapped around the arteries leading to her kidneys, and secondary cancer in her arms, legs and pelvis.

She has had regular chemotherapy and blood transfusions at London's Great Ormond Street Hospital.

At one point she required intensive care after her lungs became dangerously inflamed, and she was unable to eat anything by mouth for several months.

Her father James said: "We are obviously pleased that this new part of the trial has been launched and Sophie will be part of it."

Tumours often develop in one of the adrenal glands but may also form in nerve tissues in the neck, chest, abdomen, or pelvis.

Overall, six out of 10 children are successfully treated through treatment such as surgery and chemotherapy - but the prognosis is not as good for children with advanced forms of the disease.

Doctors estimate about 40 children per year in the UK would be eligible for - and potentially benefit from - the new treatment.

It works by hunting down neuroblastoma cells that have survived conventional treatment and attaching antibodies to specific molecules on their surface.

These antibodies then mobilise the body's immune defences to attack and destroy the cells.

The UK arm of the trial - part of a larger European one, and funded by the charity Cancer Research UK - will run in all 20 childhood cancer clinical trial centres across the UK, recruiting 160 children over the next four years.

Lead researcher Dr Penelope Brock, a consultant paediatric oncologist at Great Ormond Street Hospital, said: "Early results from the US trial found that children who received the immunotherapy treatment had less chance of the disease coming back two years later, compared with the patients who did not receive the immunotherapy.

"We need to build on these results and devise better immunotherapy approaches that improve survival further."

The UK trial - in which all eligible children will receive immunotherapy - will attempt to reduce the severe side effects seen in the US study.

James McGuire from Harrow Weald in North London, has a two-year-old daughter, Sophie, who will take part in the trial.

He said: "Based on the positive outcomes from the earlier trial, I am hopeful that this treatment will play a critical role in saving Sophie's life."

This trial will be open to high-risk neuroblastoma patients who are nine months from diagnosis and within four months of the last round of aggressive treatment to control the tumour.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8401508.stm

Published: 2009/12/10 00:03:23 GMT

'Six-hour window' to erase fear

Humans have a six-hour window of opportunity when fearful memories can potentially be erased, a study says.

Reliving a harrowing memory opens what experts call a "reconsolidation window" - a time-limited period when it can be changed from bad to good.

A New York University team was able effectively to neutralise fearful memories by acting within six hours.

They hope their work, reported in Nature, will ultimately help those with disorders like post-traumatic stress.

Naturalistic approach

In the study, the volunteers were wired up to electrodes and given a shock each time they were shown a picture of differently coloured squares to make them fearful of the image - which they did.

A day later, the investigators worked on banishing the fear.

" **Our results suggest a non-pharmacological, naturalistic approach to more effectively manage emotional memories** "
Lead researcher Dr Elizabeth Phelps

They re-exposed the volunteers to the same image, but this time without the shocks.

They found that this worked, but only if the volunteer was first made to recall the fearful experience and, critically, made to recall it no longer than six hours before the "treatment" commenced.

Also, the treatment only blocked fear for the specific coloured square for which the fear memory was recalled, suggesting that the erasure is highly specific.

" **People need to realise it is the memory that is fearful and not the current reality** "
Professor Anke Ehlers

Lead researcher Dr Elizabeth Phelps of New York University said: "Timing may have a more important role in the control of fear than previously appreciated.

"Our memory reflects our last retrieval of it rather than an exact account of the original event.

"Our results suggest a non-pharmacological, naturalistic approach to more effectively manage emotional memories."

Professor Anke Ehlers, an expert in post traumatic stress disorder at London's Institute of Psychiatry, said: "Talking about the traumatic memory can help. That's a common element of therapies.

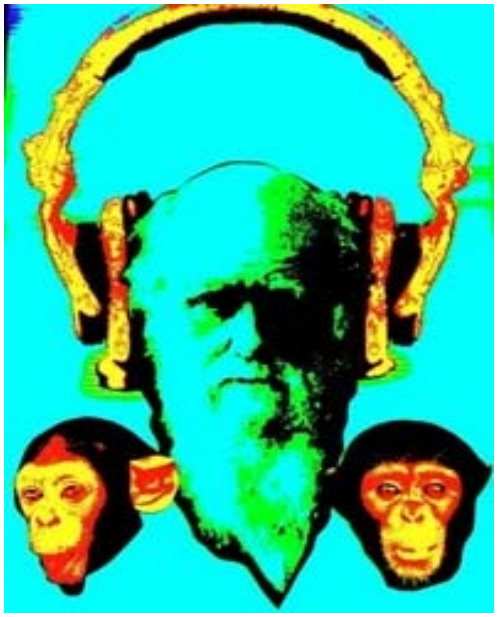
"People need to realise it is the memory that is fearful and not the current reality."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8401134.stm

Published: 2009/12/10 00:43:08 GMT

You have the power to make music... evolve

Amanda Gefter, Books & Arts editor



Participate in an online experiment to study cultural evolution in action.

At DarwinTunes.org, bioinformaticist Bob MacCallum and evolutionary biologist Armand Leroi of Imperial College London have devised a way to watch music evolve right before their eyes - and in doing so study the cultural analogue of biological evolution, also known as memetics.

Scientists are not entirely clear on how cultural evolution works, and MacCullum and Leroi are hoping their experiment will shed some light.

"For example, how important is human creative input compared to audience selection? Is progress smooth and continuous or step-like? We set up DarwinTunes as a test-bed for the evolution of music, the oldest and most widespread form of culture; and, thanks to your participation, these questions will soon be answered."

Here's how it works:
MacCullum's computer program creates a randomly generated pair of "Adam and Eve" "songs"--brief loops of sound. They mutate, recombine and reproduce to form a base population of 100 descendants.

Participants act as the force of natural selection by listening to the songs and rating them, from "I love it!" through "It's OK..." to "I can't stand it". For every 20 songs, the 10 worst rated die off, while the 10 best rated go on to reproduce at random, with each "mating" producing two new songs. Each daughter song inherits a mixture of the parents' computer codes, just as a biological organism inherits a mixture of its parents' genetic codes.

"The 'chromosomes' in DarwinTunes are actually tree structures of code," the researchers explain. "There is only one tree structure per song, that is, they are 'haploid'. During recombination a small number of tree nodes are chosen at random in one parent (each node has a 1 in 1000 chance of being chosen). The same number of nodes are then chosen at random in the other parent."

Then random mutation comes into play. Each node of a daughter's code has a one in 1500 chance of mutating. "Eighty per cent of the mutations are 'point mutations' which alter the value of a single atomic piece of information (e.g. note length, note position, wavelength multiple). The remainder are 'macro mutations' which swap, copy, insert, delete or replace part of the tree structure."

When 20 new songs are born, the 10 parents die off, and the process continues in the new generation.

MacCallum and Leroi modelled their experiment on laboratory studies of the evolution of microbes and worms, but they believe the process is similar to how music evolves in real life: "A thousand bands bang away in a thousand garages, mutate the musical idiom of the day, and test the results in the market. Most fail, but a few succeed and popular music continues its relentless evolutionary march."

MacCullum and Leroi are already seeing progress. "The result is more musical than the starting population," MacCullum says. "It was always possible that everyone would pull in different directions and it would go nowhere." The researchers have also been surprised to see how strong the effects of random mutations are on the outcome.

http://www.newscientist.com/blogs/culturelab/2009/12/amanda-gefter-books-arts.php?DCMP=OTC-rss&nsref=online-news

Brain scan reveals who will keep their promises

- 16:43 10 December 2009 by **Jessica Hamzelou**

Promises are made to be broken, so it can be tough to tell which ones will be kept. But new-found patterns in brain activity can reveal whether someone intends to keep their word.

The finding raises the possibility of using brain scans to determine the true intentions of criminals who are up for early release on parole, according to Thomas Baumgartner of the University of Zurich in Switzerland.

He and his colleagues used functional magnetic resonance imaging (fMRI) to catch promise-breakers in the act.

The team set up a game of trust between an investor and a trustee. In the game, an investor is given real money, which they can choose to invest in a trustee. Giving the money to the trustee increases the amount of money fivefold, but the investor runs the risk that the trustee might not share the winnings but keep all the money for themselves.

Promise to share

Baumgartner's team ran the game twice. The first time, investors simply had to guess whether trustees would share the winnings and then made their decision accordingly. The second, trustees could promise to share the winnings with the investor, if they wanted – although the promise was non-binding.

Almost all the trustees promised to always share their winnings, thereby securing investment. While some of them remained true to their word, others consistently broke their promise, keeping the hoard for themselves.

The trustees had their brains scanned using fMRI during both runs; they spoke to the investor from inside the scanner via an intercom.

The fMRI data revealed that certain brain areas became more active when trustees were breaking a promise. These regions – the dorsolateral prefrontal cortex, anterior cingulate cortex and amygdala – are known to be involved in emotion. They could reveal an emotional conflict in a person who knows they are doing something wrong, or feels guilty, says Baumgartner.

Parole promise

Most interestingly, similar areas were active in people who were making promises that they later broke, but not in people making promises that they ended up honouring. This suggests that the former group fully intended to cheat the investor out of their money with a phoney promise, says Baumgartner.

While others have claimed to spot liars and cheats from brain scans, Baumgartner reckons that people who intend to break a promise are different.

"Even though people are aware that they are doing something wrong, they haven't actually done anything – they still have a chance to remedy the situation and do the right thing," he says.

Baumgartner envisions a future in which brain scanners might help psychiatrists decide whether or not to release on parole criminals who promise they won't reoffend.

Minority Report

He admits, however, that a scan probably wouldn't be able to predict whether someone who doesn't intend to break a promise will end up doing so. It might also fail to pick up the false promises made by people who don't feel any emotional conflict when they do so, such as pathological liars.

"We might still see some conflict, though," says Baumgartner. "Those areas of the brain might register a conflict between saying you will do something and knowing that you won't, although this area needs more research."

However, Daniel Langleben, a neuroscientist at the University of Pennsylvania in Philadelphia, doesn't think it is appropriate to use fMRI to predict the future behaviour of criminals.

"FMRI can be very useful for other investigative and forensic purposes, but I do not think that it will ever be a safe method to use for prediction of behaviour," he says. "*Minority Report* is science fiction and so it will remain," he said.

He adds that researchers should proceed with such work with caution. "If a government or a society invests enough effort in developing an fMRI-based method to predict behaviour in criminals, it may become a self-fulfilling prophecy. People will be categorised with the poorly working method and thus hurt."

http://www.newscientist.com/article/dn18266-brain-scan-reveals-who-will-keep-their-promises.html?DCMP=OTC-rss&nsref=online-news

Our atmosphere came from outer space

- 14:28 14 December 2009 by **Shanta Barley**
- For similar stories, visit the **Solar System** and **Comets and Asteroids** Topic Guides

Comets may have created Earth's atmosphere (Image: Image Science and Analysis Lab/NASA JSC)

Comets from outer space may have created Earth's atmosphere – not volcanoes spewing out gases from deep within the planet.

The origin of the gases in Earth's atmosphere has long been a puzzle. One of the main theories is that the gases bubbled up out of the mantle via volcanoes.

Greg Holland of the University of Manchester, UK, and colleagues have arrived at a different theory after collecting samples of the noble gas krypton from several hundred metres beneath New Mexico.

They found that the mantle's chemical fingerprint was rich in "heavy" isotopes of krypton such as krypton-86 and krypton-84, and poorer in "lighter" forms such as krypton-82. This is a composition that closely resembles meteorites –- support for the ideas that gas-rich meteorites colliding in the early solar system formed our planet.

"The results confirm one of the basic ideas of planetary formation theory, that most of the Earth formed by collisions of smaller objects like carbonaceous chondrites," says Scott Kenyon at the Harvard-Smithsonian Institute Center for Astrophysics in Cambridge, Massachusetts.

Light atmosphere

But where did the atmosphere come from –- it is rich in lighter isotopes so the mantle cannot be the source, says Holland. Earth's atmosphere cannot have gained a greater proportion of lighter isotopes since it formed. Because light isotopes of krypton escape into space more quickly than heavy isotopes, the atmosphere can only get "heavier"

If not the mantle then what? Chris Ballentine, a co-author and colleague of Holland's suggests that comets could be the answer. At the outer edges of the solar system, in the Kuiper Belt, are millions of icy bodies that formed when the solar system was born. These comets have noble gas signatures that resemble that of our modern atmosphere.

A shift in Jupiter's orbit around 4.5 billion years ago may have jarred the Kuiper Belt, flinging icy comets at the Earth. "Ancient Earth was strewn with huge volcanoes spewing out gas, but our research shows that the real source of Earth's first atmosphere was actually outer space," says Ballentine, a co-author of the paper and colleague of Holland's.

Journal reference: *Science*, DOI: 10.1126/science.1179518

http://www.newscientist.com/article/dn18277-our-atmosphere-came-from-outer-space.html