Infoteca's E-Journal

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How to Learn Just About Anything Online ... For Free

By: Bill Hogan | Source: From the AARP Bulletin print edition | January 1, 2010

Photo by C.J. Burton

Stan Peirce had been looking for new pursuits after a long career as an electrical engineer with Eastman Chemical Co. in Kingsport, Tenn. Then, last year, while searching the Internet, he stumbled on nearly 2,000 academic courses that the Massachusetts Institute of Technology had put online. Peirce saw MIT's offerings—its OpenCourseWare project complete with syllabuses, assignments, exams and, in many cases, audio or video lectures—as nothing short of an educational gold mine.

"I couldn't believe all of this was available—for free," he says.

Welcome to "e-learning." Curious about world history or quantum physics? Want to stretch your mind by learning to speak a new language or to play the accordion? Need to fix a leaky faucet or teach your dog to behave? Now you can learn just about anything you want to learn without setting foot in a classroom.

Years ago the Internet paved the way for learning online from schools that charged tuition for their courses. And they still do, for academic credit. But e-learning is different. Though it doesn't earn you credits, it does allow you to learn pretty much on your own schedule, without spending a nickel on class fees.

Wave of the future

Dan Colman, who directs Stanford University's continuing studies program, sees no end to the growth of e-learning opportunities. Colman, who founded and edits Open Culture, a website that tracks free educational and cultural media on the Web, considers these materials to be an important resource for personal enrichment, not a replacement for a college education. "I think we're entering an era where lifelong learners will have access to limitless amounts of free, noncommercial educational opportunities. Arguably, we're already there."

And still moving forward, if Congress passes President Obama's $50 million proposal to develop new "open online courses" at community colleges as part of his American Graduation Initiative, announced in July. Curtis J. Bonk, author of *The World Is Open: How Web Technology Is Revolutionizing Education*,

calls Obama's plan "so spot-on in terms of what's needed," particularly because it focuses on community colleges rather than the elite universities that have led the e-learning movement. The measure passed the U.S. House of Representatives but is stalled in the Senate.

The e-learning curve

After discovering MIT's free online courses, Stan Peirce soon became a student again. His first stop: linear algebra, as taught by Gilbert Strang, a renowned mathematician and MIT professor. Then came other classes in math, chemistry and physics, all building on the biology degree he earned in 1972 but never put to use.

He's now paying for credited courses at his local community college to become a medical laboratory technician and, at 62, is eager to get back into the workforce.

"I feel like the MIT site has helped me decide what to do with my life for the next few years," he says.

Getting Started

Here are a few tools and tips to keep you at the head of your e-learning class

What kind of Internet connection do I need?
Many courses deliver classes in large audio and video files (multimedia files) that you download. That means you'll definitely want a high-speed Internet connection (cable, DSL, fiber-optic, etc.). Dial-up service is too slow.

How do I play audio and video files?
This is sometimes as easy as hitting an onscreen "download" or "play" button. You'll probably save and organize these files on your computer so that you can use them whenever you want.

Do I need special software to play files?
While many audio and video files can be played with a standard Web browser (like Microsoft's Internet Explorer or Mozilla's Firefox), you'll often need software specifically for that purpose. The easiest and most popular is Apple's iTunes. It's free. Other choices: QuickTime, Apple's basic playback software (for both Macs and PCs); Windows Media Player, Microsoft's digital media player and library, which works only on PCs; and RealPlayer by RealNetworks (for both Macs and PCs). All are free, at least in their basic versions.

How can I keep track of all the files?
There are lots of ways to organize. You could simply store them on your computer in multiple folders and subfolders, much like an electronic filing cabinet. If you use iTunes, there are seven built-in "libraries" to help you categorize.

What are podcasts?
Think of them as a subscription service for video and audio files. The files you're interested in are made available to you online for downloading via an automatic "feed." You can then watch them or listen to them whenever you want, either on your computer or a portable media player.

You mean I can learn on the go?
If you want to take your lessons with you—to the gym, on a walk—you can transfer them to a portable media player, such as Apple's iPod or Microsoft's Zune HD. Increasingly, smartphones, such as Apple's

iPhone or Motorola's Droid, are equipped to handle audio and video files. Some even double as eBook readers.

Will I need hard copies of books?
For many online university courses, you'll need textbooks or other titles on the syllabus. Online marketplaces such as AbeBooks.com and Alibris.com typically sell used textbooks for as low as $1 apiece.

Guide to E-Learning Sites

This sampling of e-learning opportunities is generally limited to video-based content that's meant to be free, without restrictions or catches. Other education and enrichment discoveries are limited only by what your search engine of choice turns up. Or stay on top of new offerings at Open Culture, which scours the Web for free cultural and educational media.

Smorgasbord sites

iTunes U. Apple has been building this online "university" and filling it with free content—at last count, more than 100,000 educational video and audio files—from top universities (London School of Economics), NPR stations (Minnesota Public Radio's "Grammar Grater," a weekly podcast about English words, grammar and usage), famous museums and other cultural institutions all over the world.

Academic Earth. Here you'll find thousands of video lectures from the world's top scholars—from Yale's Shelly Kagan on the "Philosophy on Life and Death" to investment banker Stan Christensen and former San Francisco 49er quarterback Steve Young on "Football vs. Business Negotiations."

YouTube. The rapidly expanding default site for user-generated video now includes an education "channel" called YouTube EDU, with content from top universities and other institutions.

ResearchChannel. Where on the Web can you find Milton Masciadri, professor of double bass at the University of Georgia, discuss the largest and lowest-pitched bowed string instrument used in the modern symphony orchestra? Here! A consortium of leading research and academic institutions share with the public more than 3,500 videos produced by its members.

Videolectures.Net. The site offers video lectures presented by distinguished scholars and scientists at conferences, seminars, workshops and the like. A project of the Jožef Stefan Institute in Slovenia, it has a decidedly international feel.

Standalone university sites

webcast.berkeley. The University of California-Berkeley records in lecture halls and classrooms equipped with video- and/or podcast-capture systems. In addition to hundreds of courses, the site offers on-campus lectures, debates, symposiums and other events.

Harvard@home. The site features more than 60 multimedia-rich programs on topics ranging from stem cells to Beethoven.

OpenCourseWare. Here you'll find 1,800-some academic courses—complete with syllabuses, assignments, exams, and, in many cases, audio or video lectures—that the Massachusetts Institute of Technology has put online.

How-to ...

Learning center. Acquire lots of different skills—from organizing your daily life to mastering Google Desktop—from Hewlett Packard's online classes. Each class includes up to 10 lessons and may also include interactive demos, assignments and quizzes.

WonderHowTo. Curators scour more than 1,700 websites and hand-pick instructional videos—from how to live longer (with University of Cambridge researcher Aubrey de Grey) to teaching your dog to roll over and play dead.

Howcast. Its videos run the gamut from "How to Look Great in Photographs" to "How to Jump-Start Your Car." Make your own how-to shorts in Howcast's Emerging Filmmakers Program.

Videojug. This British entry features thousands of "how to" and "ask the expert" videos on a seemingly endless array of topics.

Deep thinkers

TEDTalks. Since 1984, the annual conference that goes by the acronym TED (Technology, Entertainment, Design) has brought together some of the world's top thinkers and doers and challenged them to give the talk of their lives in 18 minutes or less. This site aggregates the best of those, including Australian science writer Margaret Wertheim's presentation about the beautiful mathematical links among coral, crochet and hyperbolic geometry.

Nobel Prize winners. The online home of the Nobel Prizes is packed with interviews with and lectures by some of the world's smartest people. There's an interview, for example, with Italian neurologist Rita Levi-Montalcini, the first Nobel laureate to reach the age of 100. (She and a colleague won the 1986 Nobel Prize in physiology or medicine for their discovery of nerve growth factor.) In it, Levi-Montalcini talks about why this latest period of her life has been the best.

Forum National Network. A consortium of public television and radio stations offers live and on-demand lectures by some of the world's foremost scholars, authors, artists, scientists, policymakers and community leaders. Recent lecture webcasts included Harvard sociologist Sara Lawrence-Lightfoot discussing her new book, *The Third Chapter: Passion, Risk, and Adventure in the 25 Years After 50*. The best starting point for accessing all the multimedia content is through the website of one of its members, the Boston-based WGBH Forum Network.

Big Ideas. This site, courtesy of TVO, Canada's largest educational broadcaster, presents lectures on a variety of thought-provoking topics that range across politics, culture, economics, art, history, science, and other fields. There's even a "Best Lecturer Competition."

Arts and sciences

Health. Three trustworthy stops: WebMD's Videos A-Z library, which has thousands of videos, catalogued by topic; HealthCentral.com's Video Library; and the University of Maryland Medical Center's Audio/Video Library, which includes interviews with UMMC experts, patient success stories and surgical webcasts.

Languages. The BBC offers audio and video language courses for beginners and intermediates in more than two dozen languages–French, German, Japanese ... even Urdu.

Cooking. Tempting sites: "Around the World in 80 Dishes" is a series of video-based cooking classes at Epicurious.com; the Culinary Institute of America, the famous school for chefs in Hyde Park, N.Y., offers

classes on its YouTube network and its podcasts on iTunes; the Food Network, allrecipes.com and the Williams-Sonoma Video Library and Look and Taste, have lots more recipes and how-to videos.

Literature. LibriVox's goal is to make all books in the public domain available as free audiobooks. Volunteers record the books, chapter by chapter, and release the audio files back onto the net.

Jazz profiles. Take the I-Train to the archive of NPR's Jazz Profiles, a documentary series hosted by singer Nancy Wilson. You can listen to the shows as podcasts, read profiles of the performers featured in the series and download the playlists for each show.

Finding Your Ancestors. The Mormon Church is well known for its repository of genealogy records, so it makes sense that Brigham Young University would offer online courses in how to research your family history.

History. The online counterpart of television's History Channel, History.com has a video library well worth checking out.

Computer programming. Maybe you've read about Ethan Nicholas, who earned $800,000 by writing an artillery game called "iShoot" for the iPhone. If you want to try your own hand, consider auditing Stanford's Computer Science 193P: iPhone Application Programming. The 10-week undergraduate course attracted 150 students for only 50 spots when it was introduced on campus last fall. Online viewers see the same lectures as classroom students.

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http://bulletin.aarp.org/yourworld/reinventing/articles/freelearning.html

Information: The New Weight-Loss Drug

By: Elisabeth Best | February 2, 2010 | 13:03 PM (PDT) |

Research shows that nutritional information about fast food inspires parents to make healthier choices for their kids.

McDonald's Cheeseburger: 300 calories. Small Fries: 230 Calories. One percent Low Fat Chocolate Milk Jug: 170 Calories. Watching your child gain 10 pounds in one year? Priceless.

It's no secret that childhood obesity in America is on the rise. Nor is it surprising that this rise has been paralleled by a growth in the nation's fast-food consumption. But a new study led by Pooja S. Tandon from Seattle Children's Research Institute suggests a new item for Happy Meals: information. She found that parents provided with calorie information on a fast-food menu chose meals for their children with an average of 102 fewer calories than parents without the facts.

The findings, published online in *Pediatrics* on Jan. 25, indicate that nutritionally informed parents may make healthier choices for their kids.

The researchers surveyed 99 parents of 3- to 6-year-olds who sometimes eat in fast-food restaurants about their fast-food dining habits. They presented the parents with sample McDonald's menus featuring product pictures and prices, and asked them to choose a "typical meal" for themselves and their children. The menus included most McDonald's fare, including a variety of sandwiches, sides, drinks and desserts. Half the parents received menus with clearly visible calorie information, and half did not.

The parents who were given the calorie information chose 20 percent fewer calories for their children — 102 on average — than parents without the information on their menus. Tandon suggests that even small calorie adjustments on a regular basis can prevent weight gain, and an extra 100 calories a day could add up to 10 pounds in a year.

"Interestingly, by simply providing parents the caloric information, they chose lower calorie items. This is encouraging, and suggests that parents do want to make wise food choices for their children, but they need help," Tandon was quoted in a release.

Nutritional information didn't, however, lead parents to make smarter food choices for themselves. There wasn't any difference in the calorie counts of the meals parents picked for themselves between the two groups.

This reinforces earlier research suggesting that healthy choices on a menu might actually cause some people to choose less-healthy foods. It seems that putting a salad on the menu erodes some people's ability to choose, for example, a not-so-bad-for-you baked potato over saturated-fat-laden fries.

But even if calorie counts help parents make better choices for their children, a study published earlier this month shows that the counts themselves may be off by as much as 200 percent. On average, Tufts University researchers found that restaurant menu calorie counts were 18 percent lower than the actual calorie content of the food.

So while nutritional menu labeling may help parents select better meals for their children, it's important to keep in mind that the numbers might not be exact (or even close).

http://www.miller-mccune.com/health/information-the-new-weight-loss-drug-8261/

The Empowering Power of Ice

By: David Richardson | February 8, 2010 | 11:11 AM (PDT) |

Blocks of ice are joining molten salt and compressed air as ways to deliver yesterday's energy when it's wanted today.

Just when most of the country has "had it up to here" with ice, a coalition of publicly run electric utilities in Southern California say it has plans to cool the state's energy problems by making even more.

The Southern California Public Power Authority announced last month it plans to construct a 53 megawatt energy storage project over the next two years to store power — in blocks of ice.

David Walden, energy systems manager for the authority, said on-peak power demand is the one of the biggest problems facing the region's electric utilities. He told Miller-McCune that power purchased during peak hours is not only "expensive," but that the generators "typically dispatched within the industry to meet peak demand are the most inefficient units that we have."

In a press release, the authority said its new project will "permanently reduce California's peak energy demand by shifting as much as 64 gigawatts of on-peak electrical consumption to off-peak periods." How? By switching off air conditioners and instead, using thousands of tons of ice to cool commercial space.

The authority plans to deploy an energy storage system called Ice Bear, developed by Windsor, Colo.-based Ice Energy. The units will be distributed among 1,500 rooftop and commercial air conditioners over the authority's 7,000-square-mile service area. Tied in to normal rooftop air conditioners, Ice Bear units will be used to freeze hundreds of gallons of water nightly, when demand for power, and its price, are lower.

During torrid working hours when air conditioners are the major draw on California's power grid, Ice Bear switches off air conditioning and circulates the warm air from the building's interior over special panels chilled by melting ice. The resulting cool air is then pumped through the ventilation system back into the building.

Once the ice is completely melted, which Ice Energy said takes about six hours, the air conditioning system switches back into normal operation and the cycle starts again. By that time, the power authority said, the peak-load period will have passed, resulting in less strain on the power grid and "an overall 8 percent efficiency advantage" for the customer.

Shifting energy generation away from demand has become more common, especially with renewable sources that can't produce on demand. Solar projects, for example, may use molten salt or compressed air to release the sun's energy once it's gone down. Other projects have called for pumping water into upstream reservoirs at night when rates are cheaper, then letting it gush through hydroelectric facilities during peak hours.

Ice Energy, for its part, likens its product to using a battery, but without heavy metals or noxious chemicals.

Much of California's historical summer electricity shortfalls have occurred on hot days when air conditioners suck up to a third of the state's electricity and either generation or transmission can't keep up. Meanwhile, climate change, not surprisingly, is expected to make the pinch worse.

Bill Carnahan, the authority's executive director, said the project "is a convenient and cost-effective solution for managing peak demand. By using storage to change how — and more importantly when — energy is consumed by air conditioning, we can offset enough peak demand in the region to serve the equivalent of 10,000 homes."

This isn't the Ice Energy's first foray into California, having worked on much smaller scales with the Pacific Gas and Electric Company's "Shift and Save" program since 2007, and the city of Redding since last summer.

Walden said signing up for the program is relatively simple. "We do all the installation," he said. Customers need only provide an access agreement similar to that used for any other piece of utility equipment, such as a transformer or meter.

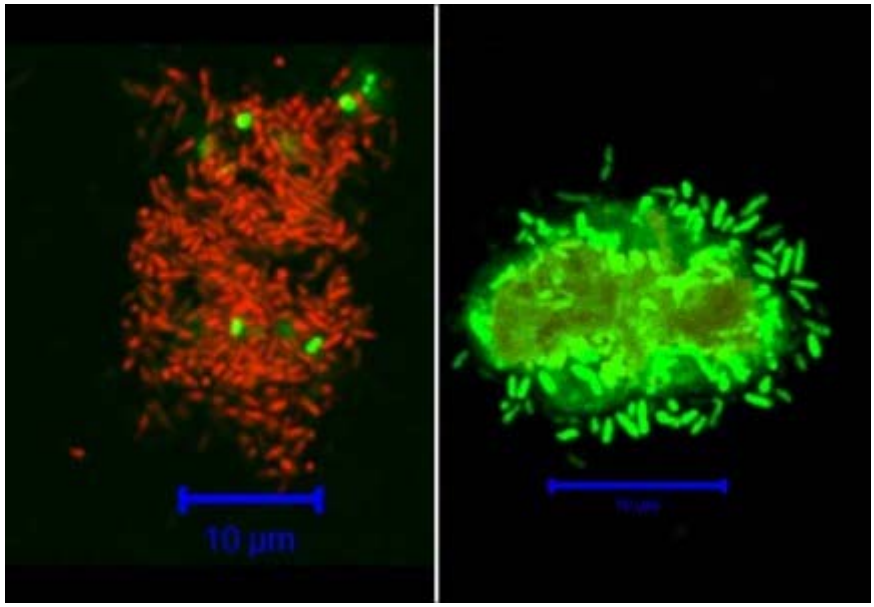
"The system is compatible with 85 percent of existing air conditioning units," he said. And cooling with ice made overnight consumes less electricity than running air conditioners during the day, "partly because it's cooler at night, and partly because the small compressors used to make ice are more efficient than the larger compressors used on commercial air conditioners." He added that air conditioners' life spans increase because they aren't on as much.

Walden said the authority has been using the system on its own buildings "for over five years. … There's a lot of history behind the product showing that it works."

http://www.miller-mccune.com/business-economics/the-empowering-power-of-ice-8640/

'Roach Motels' for Bacteria

By: Michael Haederle | February 5, 2010 | 10:20 AM (PDT) |



'Microspheres' prove devastatingly effective in trapping and killing tiny threats like bacteria and spores.

In the age-old battle between man and microbe, people have tried in countless ways to keep their surroundings germ-free, ranging from plain old scrubbing, heat sterilization and chemical disinfectants to high-tech solutions like irradiation or drug-eluting coatings.

Now a new approach could make it easier to keep disease-causing bacteria from forming noxious invisible biofilms on surfaces.

Researchers at the University of New Mexico and the University of Florida have developed polymer microspheres that trap and kill bacteria — in effect tiny antimicrobial "roach motels."

Coatings made from these structures, technically known as "conjugated polyelectrolyte capsules," have proved their mettle in the laboratory against a variety of bacteria and even some spores, raising the possibility that they could be effective against virulent strains, like anthrax, says biochemist David Whitten, associate director of UNM's Center for Biomedical Engineering.

"We also think these should be equally effective against ordinary bacteria and the so-called antibiotic-resistant bacteria," Whitten says.

Unlike some other attempts to use nanotechnology to fight microbes, the microspheres behave like catalysts, meaning they aren't depleted in the bacteria-killing process. "These are essentially permanent coatings," Whitten says.

Remarkably, the spheres only seem to exert their properties against bacteria and spores. "At least in our initial studies, we found that these polymers that are active against bacteria are not killing mammalian cells, which is very nice," he says.

Whitten has also found that the spheres make an effective germicidal barrier on cotton and nylon-cotton fibers, suggesting that they could one day be used to make antimicrobial clothing, disposable bandages, baby swabs and curtains.

"I've been thinking about health applications," says Whitten, who thinks the spheres could even be incorporated into paint and applied to the walls of hospital rooms and commercial kitchens. In sterile settings, where people might track in bacteria on their shoes, "I could see where you might have disposable shoe booties that people could put on," he says.

Other teams have experimented with germicidal microspheres of varying sizes in recent years.

At Brown University, scientists created iron oxide particles just 8 nanometers in diameter that can be guided to the site of an infection in the body with magnets and activated. The metallic particles penetrate bacterial membranes, killing them.

Meanwhile, researchers at Auburn University reported that they had used minute super-strong structures, called single-walled carbon nanotubes, to attach a natural cell-busting enzyme called lysozyme to surfaces, creating a durable germicidal barrier.

Still other approaches include biodegradable microspheres that release antibiotics over an extended period or using spheres to deliver silver nanoparticles that can disrupt bacterial cell membranes.

Whitten has been working with his water-soluble conjugated polyelectrolytes for some time. "These are referred to by many people as [electrically] conducting polymers," he says. "They're really fascinating compounds." While on staff at Los Alamos National Laboratory, he and a colleague started a business to develop bio-sensing units based on these polymers.

They began to realize that these molecules might have antimicrobial properties because of the positive electrical charge that they carry. "We know that bacteria for the most part have a negative charge," Whitten noted.

After relocating to UNM in 2005, Whitten received funding from the Defense Advanced Research Projects Agency, enabling him and his colleagues to whip up a batch of the polymer. "We found if you take a solution of these polymers and add that to a suspension of bacteria, the bacteria rapidly become coated with the polymer," he said.

A year ago, having established that the polymers worked in solution, Whitten and his colleagues decided to see if they could layer them over a template and build three-dimensional microspheres out of the material.

The technique, developed by various research labs over the past half dozen years, starts with a tiny template of manganese carbonate 5 microns in diameter (about one-twentieth the width of a human hair). The polymer is deposited on the template in four oppositely charged layers.

Then the spheres are dipped in a solution that dissolves away the manganese carbonate. Viewed under a microscope, they look a little like deflated whiffle balls. The manufacturing process leaves tiny holes in the spheres through which the bacteria can enter, but not exit, Whitten says.

The polymers were first tested on *E. coli* bacteria and on the Sterne strain of anthrax spores (which are thought not to be harmful to people). "Those were both killed by the polymers," Whitten said. Time-lapse fluorescent microscopy shows free-swimming bacteria concentrating around the microspheres, where they die.

In a paper published in the journal *Applied Materials and Interfaces* last year, Whitten's team reported that the conjugated polyelectrolytes were effective against Pseudomonas aeruginosa, a so-called Gram-negative bacterium that is the second leading cause of infection in hospital intensive care units.

The original tests showed that these polymers have significant bacteria-killing properties in darkened laboratory vessels. But they kick into overdrive when exposed to light. "As soon as you hit them with visible light, the bacteria are gone," Whitten said.

"It's pretty clear there's a dark process where this coating interacts with the bacterial membrane and eventually breaks it down," he said. "The polymer is then very close to the inner part of the bacteria. This process in the dark can eventually kill bacteria."

Exposure to light is thought to excite the polymer into releasing singlet oxygen, a highly reactive molecule that more rapidly kills the bacteria, improving the germicidal efficacy to 99.99 percent in some cases, Whitten said.

Meanwhile, each microsphere seems to act a little like fly paper for bacteria, with seven or eight bacteria adhering to it. "We're trying to understand why these capsules are so effective," he said. "[They] seem to … exude almost like tentacles and they tend to trap the bacteria."

The process tends to leave behind a plaque of dead bacteria. Now the team is looking at thermally activated chemical processes to clean the coated surfaces so that they can continue doing their work, he said. They are also experimenting with larger microspheres made with coated silica, which could collect more bacteria and perhaps be useful for things like water purification, he said. One of Whitten's collaborators is also trying to modify the polymers so that they release even more reactive oxygen molecules.

Whitten is optimistic that because the microspheres kill bacteria in a unique way, germs may be unable to evolve immunity to them. "Most bacteria that develop antibiotic resistance either find a way of deactivating the antibiotic, or more often, just getting it out of their system really quickly," he said. "I don't think either of those strategies would work with this."

Whitten and his collaborators have filed for several patents since launching their research. Meanwhile, some biotech companies have expressed interest in licensing the technology. Whitten says he's content to stay in academia.

"I've started one company," he said. "It was exciting. It was really fun. It was exciting, but I'm too old to do this again. But I would love to be involved in an effort to take this forward."

http://www.miller-mccune.com/science-environment/roach-motels-for-bacteria-8425/

Give Me Something to Believe in

By: Erik Hayden | February 4, 2010 | 11:55 AM (PDT) |

Adolescents are aware of the serious consequences of climate change. So why don't they do anything about it?

"Some say irreversible consequences are 30 years away," states a grimacing global warming skeptic as a locomotive roars in the distance. "That won't affect me," he deadpans before brazenly stepping off the tracks — allowing a child to get mowed over by an oncoming train.

This Environmental Defense Fund commercial, like many catchy and provocative campaigns before it, illustrates the trend of environmental moralizing by well-meaning organizations. Every year, millions of public and private dollars are spent in order to spur Americans, particularly youth, to engage in small but meaningful conservation behaviors to combat global warming and reduce their carbon footprint.

And every year, it appears, adolescents tend to ignore these pleas.

A new study by Pennsylvania State researcher Laura Wray-Lake finds a precipitous decline over the past 30 years in the proportion of adolescents who believe that the world's natural resources are scarce, who take personal responsibility for environmental caretaking and who regularly engage in conservation behaviors.

The research, which culled data from the annual nationwide Monitoring the Future survey, examined more than 100,000 randomly sampled high school seniors' responses between the years 1976 to 2005 to map how attitudes toward the environment had changed. Researchers examined multiple categories such as propensity toward materialism, belief in resource scarcity and self-reported conservation behaviors.

"Trends clearly indicate that youth in the past two decades were not as willing to endorse conservation behaviors of cutting down on heat, electricity, driving and using bike or mass transit as were young people in the '70s," the authors wrote. The proportion of adolescents who reported cutting down their electricity "quite a bit" to conserve energy declined from an all-time high of 73 percent in 1980 to about 48 percent in 2005.

Researchers also found that during periods when self-reported "materialism" rose among adolescents, youth were also less inclined to perceive that natural resources were limited. In 1980, 81 percent of youth believed that resources were scarce compared to only 46 percent in 2004. "It was somewhat disheartening to find that youth's belief in resource scarcity declined so substantially given that we know non-renewable resources grow increasingly scarce across decades," Wray-Lake stated.

On first glance these declines are perplexing, especially given the assumption that Millenials are the most "eco-conscious" generation. But hyper-awareness of potential climate change devastation, it seems, doesn't translate into tangible action. Even though youth may want to help save the environment, they seem to be unwilling to part with a lifestyle that is incompatible with these efforts. Instead, they have steadily shifted the burden of responsibility for environmental caretaking from the individual to the government.

Throughout the past 30 years, adolescents were "more likely to endorse consumer responsibility and the government's responsibility to protect the environment than they were to report a personal effort to conserve environmental resources," the authors noted. Considering that the U.S. government has perpetually been at a standstill with regards to enacting sweeping climate change and conservation legislation, this revelation isn't encouraging news.

Adolescents, as the study suggests, would like to see action taken to preserve the environment — they just want somebody or something else take the initiative. "For young people, faith in [future] technology goes hand in hand with personal commitments to the environment," Wray-Lake wrote. "That is, at times when youth believed that technology would solve problems that arise, they were also likely to positively endorse a personal responsibility to preserve the environment."

In the same manner, at times when youth believed the government was taking the lead in conservation efforts (the promotion of Earth Day 1990 was cited as one such moment), they were more likely to do their part by cutting down on electricity, using mass transit or engaging in other conservation behaviors.

This "follow-by-example" mentality could prove to be a successful blueprint for engaging today's adolescents. The groundswell of enthusiasm for films and grassroots promotions such as *An Inconvenient Truth* and the Obama administration' "green" aspirations (which, again, haven't yet come to fruition) might stem the 30-year decline.

At the very least, this mentality seems more agreeable than the tried-and-true alternative: the guilt-trip.

http://www.miller-mccune.com/science-environment/give-me-something-to-believe-in-8156/

The Wal-Mart Catechism

By: Erik Hayden | February 3, 2010 | 17:45 PM (PDT) |

A new book on the discount chain's down-home early days doesn't tell us much about its status as the world's largest — and most controversial — retailer.

Last November, voters in Ventura, Calif., faced a dilemma common to many midsized communities: What, if anything, can be done about Wal-Mart?

There seemed to be no legal way to stop the Arkansas-based behemoth from opening a store in the area, so a coalition of activists and grocery store unions crafted a ballot measure to restrict the size of the store and the types of goods it could sell. Backers argued that the proposal would prevent a Wal-Mart "superstore" from cannibalizing local businesses and undercutting high-wage union jobs at area grocery chains.

As the Wal-Mart debate raged — in furious editorials, scathing campaign posters and bristling public statements — one thing became clear: Not even those opposed to the poorly written ballot measure seemed enthusiastic about the corporate juggernaut rolling into town. On Election Day the measure failed by a healthy margin, opening the door for a full-sized Wal-Mart in Ventura.

In the aftermath of the bitter campaign, however, the company found few friends in public. Many supporters admitted the store was likely to be an eyesore and cause traffic gridlock. Even some pro-business City Council members who had attacked the "populist" ballot measure announced that they wouldn't patronize the superstore but would instead shop at the mom-and-pops that litter Ventura's quaint downtown strip — the same stores that may be driven out of business after a Wal-Mart opens.

At first glance, professor Bethany Moreton's weighty study, *To Serve God and Wal-Mart*, appears to be another in a long line of academic diatribes (*American Fascists* and *Fall of the Evangelical Nation* come to mind) that belittle the connection of Christian fundamentalism with unbridled capitalism. Despite its title, Moreton's book — refreshingly — does not dwell negatively on the allegedly world-conquering power of religion and free enterprise. But in her insistence on presenting a neutral historical study that

focuses on the early years of Wal-Mart, she has created a painstakingly researched treatise with little overarching perspective.

For all the salient information she uncovers in interviewing employees, combing the archives of Wal-Mart World (the company's in-house periodical) for details and documenting Bible Belt sensibilities and eccentricities, Moreton fails to take the next logical step and combine the details she's unearthed in a central theme. Her book therefore raises a simple question: How, exactly, are we supposed to feel about rise of this "Christian" mega-corporation? Is anger, disappointment or indifference the right reaction?

Wal-Mart Background

Wal-Mart founder Sam Walton would've liked you to believe that his initial storefront, opened in 1962 in Rogers, Ark., began with humble intentions. In reality, the grand opening of "Wal-Mart Discount City" was the first in a series of calculated gambles aimed at expanding his department store chain and monopolizing the "basic goods" industry.

Shrewdly, Walton avoided competing with Kmart and other discount chains located in cities by targeting smaller towns near military installations, state institutions and other administrative centers. The first 50, mostly Southern towns that Wal-Mart settled in during the late 1960s and early '70s had a median population of just 9,000, but the business thrived by aggressively positioning itself as a super-sized version of the rural mom-and-pop stores that it eventually supplanted.

To cultivate and maintain its folksy image, Wal-Mart used careful central planning, community-building efforts and savvy promotional techniques. Executives and managers modeled the demeanor of Sam Walton, clothing the corporation's sometimes-ruthless free-market practices in an imagined rugged, homogenous America of yesteryear that was part Davy Crockett and part *Leave It To Beaver*, with church potluck dinners thrown in for good measure.

Although the company reveled in nostalgia, it seemed "Christian" only in the sense that it tried to mirror the prevailing culture of the South. The founder's pastor summed up the company's Christian underpinnings neatly: "When it's not bird-hunting season and he's in south Texas, every Sunday Sam Walton is in church." In essence, Walton intended Wal-Mart to be a homegrown, values-centered community filled with eager managers and employees whom you might otherwise run into at Sunday service.

In this insulated, country music-playing theme park, many customers — often women looking for part-time jobs — became employees who assumed roles that actively promoted the Wal-Mart vision of Christian populism. Central to this vision were a stringent adherence to professionalism and an unwavering commitment to having a good attitude. Because Wal-Mart was often the largest institution in rural Southern communities, customers were often friends and neighbors. It was natural that early on the company developed a reputation for genuinely friendly employee service — something that Walton constantly emphasized.

Despite the founder's protests to the contrary, it was actually Wal-Mart's innovative organizational techniques that allowed it to dominate the retail sector. Unlike the urban department stores that lured customers with luxurious display, Wal-Mart trailblazed the idea of corporate populism, casting exorbitant consumption of cheap items as — in the words of the author — "procuring humble products 'for the family.'"

The company's sanitized, no-frills warehouse design, deep discounts and glaring florescent lights were designed to send one message: Shopping here is the most sensible option. Conspicuous consumption became acceptable for the middle and working classes, as long as they bought cheaply and in bulk.

To provide the deep discounts that are Wal-Mart's calling card, the company used its scale to negotiate low prices from manufacturers, and also looked to scrimp in other ways, especially on pay and benefits.

Wal-Mart executives handed out token "management" positions to even low-level employees and used legions of "part-time" workers. While Walton and his executives felt that a supervisory title would boost employee morale, the titles also served a more practical purpose — the company could avoid shelling out overtime pay. And part-time workers were not, under the federal laws then in effect, eligible for benefits.

Indeed, it's more than ironic that a company relying almost entirely on low-level "managers" and the part-time labor of women could, to paraphrase Moreton, enjoy an almost unshakeable reputation as a family business that instilled widespread loyalty, even devotion, in these workers.

If Wal-Mart's early employees ever grumbled loudly, it's not evident in Moreton's book. She seems to have combed the archives of Wal-Mart World to find endless examples of employees who extolled the virtues of the company's Christian service ethos. "A fellowship hour like this makes you realize that Wal-Mart is the only place to work," gushed a staff member of one Oklahoma store, echoing a sentiment expressed by many Southern employees.

Values Employees

Why do these early employees appear to be so loyal? The author argues that commonly held values, including Bible Belt evangelicalism, along with an absence of other unifying institutions in these small towns transformed Wal-Mart from a mere corporation into a community center where employees and customers could gather, swap stories and, of course, shop. Christianity was able to provide the moral compass that guided the economic engine of free-market capitalism.

This unwieldy but successful fusion of values and commerce is rife with contradictions and complexities that have become ever more apparent in the current post-"values voters" era. The Wal-Mart superstore is now as polarizing as it once was unifying. As the largest cultural symbol to be inextricably wed to red-state evangelicalism, it has borne the brunt of the (sometimes excessive) criticism that similar competitors like Ikea and Target have largely avoided.

Certainly the company has grown far too large to limit its corporate-populism to only the "real America" of the rural South. But how can it possibly recraft its image to appeal to the nation's bluer regions?

The increasingly ambivalent response to Wal-Mart's constant expansion in America and around the world could have been the focal point of *To Serve God and Wal-Mart*, but Moreton's lips are frustratingly sealed. Content to relay the history and culture that accounted for the company's dramatic ascent to corporate dominance, she leaves much of the questioning to others. Any emergent theme seems to be set hopelessly adrift in all the (fascinating) details Moreton dredges up from Sam Walton's personal writings and the bottomless archive of Wal-Mart World. Without any apparent central argument, the book reads as a well-documented, objective, historical narrative that seems slightly inadequate to the global debate that swirls around the world's largest retailer.

http://www.miller-mccune.com/business-economics/the-wal-mart-catechism-8279/

Can Drug Policy Prevent Reefer Madness?

By: Elisabeth Best | February 7, 2010 | 05:00 AM (PDT) |

A cross-national comparison of alcohol and marijuana use among adolescents indicates that stricter laws may prevent high school kids from drinking, but not from smoking pot.

Raise your hand if you've consumed an alcoholic beverage or smoked marijuana in the last month. Raise your hand if you abstained from using alcohol until you were of legal age. Now, raise your hand if you refrained from smoking pot in the last month because it's illegal. Anyone?

Do strict alcohol and marijuana laws actually prevent their use? That's the question a team of researchers set out to answer in a recent paper published in the *International Journal of Drug Policy*. Their cross-national comparison of drinking and cannabis use among 10th-graders indicates that although strict alcohol laws may prevent kids from drinking, strict marijuana laws don't do much at all to curb use.

Bruce Simons-Morton, William Pickett, Will Boyce, Tom F.M. ter Bogt and Wilma Vollebergh chose the United States, Canada and the Netherlands — countries with significantly different drug and alcohol policies — for their case studies.

The founded-by-Puritans United States is the strictest of the three, with a national drinking age of 21 (although many university presidents and chancellors would prefer it at 18). The country treats alcoholic beverage purchase, possession and, in some states, consumption as criminal offenses. It also has the strictest marijuana laws: Purchase and possession (in some states) of marijuana are criminal misdemeanors, and 23 of the 50 states require mandatory sentencing for possession of relatively small amounts.

Canada has a more moderate stance on alcohol and drug use. The legal drinking age is 19 in most of Canada, but only 18 in three of its provinces. Marijuana possession and use in Canada is treated as a statutory offense (in most cases), resulting in a fine but not a criminal record or incarceration. However, it is often overlooked by law enforcement. In fact, Vancouver, British Columbia, has become arguably the world's most drug-tolerant city — one in which, as a 2008 *Miller-McCune* story documents, drug use is approached as a social problem and not a criminal offense. Junkies have government-provided

paraphernalia, a clean place to shoot up, and, in some cases, drugs; marijuana users can openly smoke "B.C. bud" on the streets.

The Netherlands, home of Amsterdam's legendary "coffee shops", takes the cake for the most liberal drug and alcohol policies of the three nations. The Dutch have no minimum drinking age, but 16 is the minimum age to purchase alcohol. Regulated sales of small amounts of cannabis in "coffee shops" are legal for anyone over the age of 18. Although it is technically illegal to grow and sell the plant, police don't make drug enforcement a priority.

Canada and the Netherlands take the harm-reduction approach in their policies, meaning that they hope to reduce higher risk use, like drinking and driving, but keep the costs to society of enforcement (incarceration, etc.) low. In Canada, 2,236 juveniles were arrested for drug-related offenses in 2006; in the Netherlands, juvenile arrests for possession of alcohol or marijuana are practically unheard of.

In the United States, a country that makes enforcement a priority, there were 168,888 arrests of juveniles for drug use in 2006, most of which were for cannabis possession, and 250,000 alcohol-related arrests of individuals, mostly for underage drinking, in the same year.

The researchers used the Health Behaviour in School-Aged Children survey, which assesses a number of variables, including substance use among 10th-graders, to inform their study. It asks students a number of questions to measure the prevalence of alcohol and cannabis use, the age of first use, and the frequency of drunkenness. (The study's authors acknowledge that there is some element of subjectivity in self-reported drunkenness, but assert that it has been used successfully in several other papers).

They found that, for most measures, drinking was more prevalent in Canada and the Netherlands for boys and girls than in the United States. Approximately 19 percent of American boys reported weekly drinking, compared to 22 percent of Canadian guys and a whopping 52 percent of Dutch males. The pattern is similar for girls: 13 percent in the U.S., 17 percent in Canada and 33.4 percent in the Netherlands said they drank weekly. These results confirm those of previous studies, which have shown that stricter alcohol laws do reduce use (and underage drunken driving).

However, the rates of kids using marijuana were not significantly different among the three countries, in spite of significant variation in policy and enforcement. Cannabis use among boys in the United States was actually the highest (excuse the pun) of any group in the study.

Rates of use in the past 12 months and use in the past 30 days were pretty similar for boys and girls across national boundaries: about 20 percent of boys overall reported use in the last month, and almost 17 percent of American and Canadian girls reported the same. Dutch girls were the one exception, reporting the lowest frequency of use (only 11 percent had used the herb in the past month).

The researchers conclude, "The data provide no evidence that strict cannabis laws in the United States provide protective effects compared to the similarly restrictive but less vigorously enforced laws in Canada, and the regulated access approach in the Netherlands. … The question remains for policymakers in each country to determine the extent to which policies regarding adolescent substance use maximize prevention benefits while minimizing social consequences."

In other words, as the economic crisis rages on, it just might be time for a "Clunkernomics"-style evaluation of America's drug policy. Then again, maybe that's already started.

http://www.miller-mccune.com/legal-affairs/can-drug-policy-prevent-reefer-madness-8424/

Female Teachers Add to Students' Math Anxiety

By: Elisabeth Best | February 5, 2010 | 15:15 PM (PDT) |

Highly math-anxious female teachers may lead girls to conform to the stereotype that, when it comes to math, they just can't compete with the boys.

In spite of the multitude of research indicating otherwise, the assumption that boys are biologically better at math than girls is alive and well at schools across the nation. And a new study indicates that when female teachers believe the stereotype, they pass their own mathematical anxiety on to the girls in their classes.

While the perpetuation of the idea is troubling, the implications are more so: The girls who believe their gender possesses inferior math skills do significantly worse in the subject than the girls who don't.

Researchers at the University of Chicago conducted a yearlong study of 17 first- and second-grade teachers and their classes. They found that a female teacher's math anxiety did not affect boys' performance — but it did affect girls' math achievement.

Their results, published in the Jan. 11 issue of *Proceedings of the National Academy of Sciences*, indicate that a highly math-anxious female teacher may lead girls to conform to the stereotype that, when it comes to math, they just can't compete with the boys.

The findings are particularly worrisome since women make up more than 90 percent of elementary school teachers in the United States. Teaching certificates require very little mathematical knowledge or preparation, and research has shown that students majoring in elementary education have higher rates of math anxiety and lower proficiency rates in it than other college majors.

To determine the effects of a teacher's math anxiety on her students, researchers tested individual students' mathematical achievement and gender stereotypes at both the beginning and the end of the school year. They also assessed each teacher's level of anxiety.

After hearing gender-neutral stories about students who were good at math and good at reading, students were asked to draw a picture of a child who was good at each subject. The researchers used the drawings (Did Susie draw a boy or a girl as the good-at-math student?) to assess gender stereotypes.

When school started in the fall, student math achievement wasn't related to their teachers' feelings about math. But by the end of the school year, the more anxious a teacher was about the subject, the more likely girls — but not boys — in her class had adopted the view that "boys are good at math and girls are good at reading."

The girls who believed the stereotype scored six points lower in math achievement than either the boys or the girls who hadn't developed an opinion on it. This suggests that the lack of women in math- and science-intensive fields like engineering needs to be addressed much earlier in the game than initiatives providing college scholarships for women going into engineering or chemistry.

The authors of the study echo the sentiments of Leon Botstein, suggesting that elementary school teacher preparation programs require more math in their curricula and address teacher uncertainties about the subject.

However, they leave untouched (perhaps wisely) the "multiculturalism-to-math ratio" debate.

http://www.miller-mccune.com/culture-society/female-teachers-adding-to-students-math-anxiety-8301/

Social Networking Breeds Better Citizens? LOL!

By: Tom Jacobs | February 3, 2010 | 11:43 AM (PDT) |

Facebook friends, Romans, countrymen, lend me your earbuds. But don't ask me to name the Speaker of the House.

Remember those reports that social networking Web sites are transforming American politics, changing the way voters get information and drawing previously disengaged young people into the system?

A new study suggests such stories shouldn't be taken at face(book) value.

In the February issue of the journal *Social Science Computer Review*, East Carolina University political scientists Jody Baumgartner and Jonathan Morris — authors of a much-discussed 2006 study suggesting *The Daily Show*'s campaign coverage on Comedy Central breeds cynicism — conclude idealistic visions of a knowledgeable, activist cyber-citizenry are, at best, premature.

The researchers analyzed a survey of more than 3,500 18- to 24-year-olds conducted just before the 2008 Iowa caucuses. Participants were asked to name their news sources (including comedy shows) and quizzed on both their general political knowledge (which party has a majority in the House and Senate?) and their awareness of the presidential candidates (who is a practicing Mormon?).

Eighty-eight percent reported they had created a personal profile on a social networking site such as Facebook or MySpace; 48 percent said they get news from such sites at least once a week. But all that online interaction did not mean they were particularly well-informed.

"Although social network Web site users were slightly more knowledgeable about the field of presidential candidates than nonusers, their knowledge did not appear to extend to the political world in general," Baumgartner and Morris write. "Social network Web site news consumers follow news about public affairs, but to a limited extent relative to other types of news, and are not particularly interested in pursuing diverse sources of news and/or ideas."

Rather, "Users of these sites tend to seek out views that correspond with their own," the researchers add — a disappointing finding that suggests social networking Web sites may be the online equivalent of cable news networks.

They add that "although social network news users were more likely to engage in Internet-based political activity (blogging, forwarding a political e-mail), they were not more likely to participate in more conventional activities such as voting."

Oh, that.

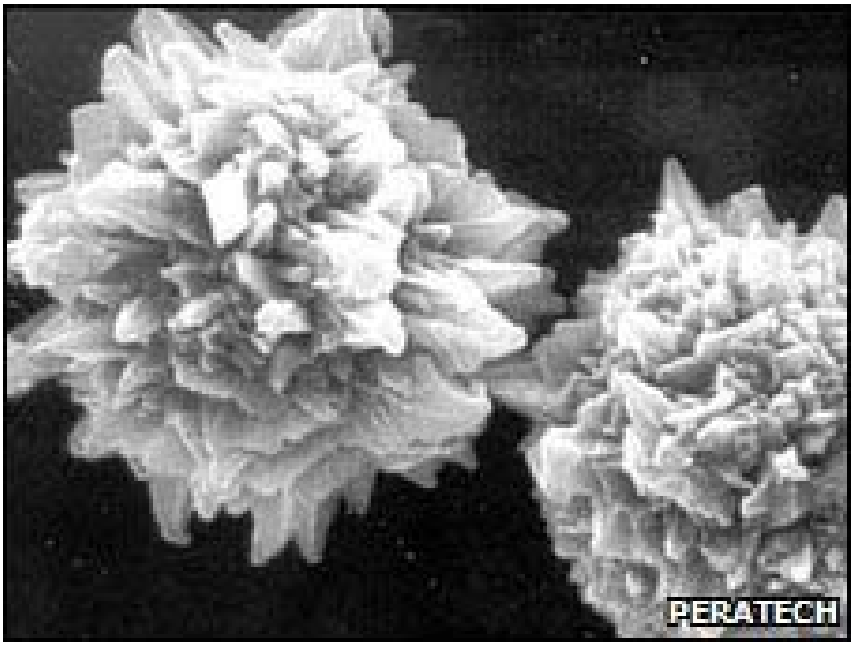
Social networking is a relatively new phenomenon, of course, and the Web can evolve quickly. But Baumgartner and Morris conclude that as of now, "the hyperbole surrounding new Web developments as they relate to citizenship may be just that — hype."

http://www.miller-mccune.com/culture-society/social-networking-breeds-better-citizens-lol-8385/

Smartphone keys get quantum trick

By Jason Palmer
Science and technology reporter, BBC News

Hand-held devices could soon have pressure-sensitive touch-screens and keys, thanks to a UK firm's material that exploits a quantum physics trick.



The technology allows, for example, scrolling down a long list or webpage faster as more pressure is applied.

A division of Samsung that distributes mobile phone components to several handset manufacturers has now licensed the "Quantum Tunnelling Composite".

The approach could find use in devices from phones to games to GPS handsets.

In January, Japanese touch-screen maker Nissha also licensed the approach from Yorkshire-based Peratech, who make the composite material QTC.

However, as part of the licensing agreements, Peratech could not reveal the phone, gaming, and device makers that could soon be using the technology to bring pressure sensitivity to a raft of new devices.

Besides control for scrolling, the pressure-sensitivity could lead to a "third dimension" in touchscreens.

For instance, instead of many "2-D" pages of applications, they could be grouped by type on a single page - using the press of a finger to dive into each type and select the desired app.

Quantum mace

The composite works by using spiky conducting nanoparticles, similar to tiny medieval maces, dispersed evenly in a polymer.

None of these spiky balls actually touch, but the closer they get to each other, the more likely they are to undergo a quantum physics phenomenon known as tunnelling.

Tunnelling is one of several effects in quantum mechanics that defies explanation in terms of the "classical" physics that preceded it.

Simply put, quantum mechanics says that there is a tiny probability that a particle shot at a wall will pass through it in an effect known as tunnelling.

Similarly, the material that surrounds the spiky balls acts like a wall to electric current. But as the balls draw closer together, when squashed or deformed by a finger's pressure, the probability of a charge tunnelling through increases.

The net result is that pressing harder on the material leads to a smooth increase in the current through it.

There are a number of ways to make switches or screens pressure-sensitive, such as using mechanical switches.

However, the QTC approach is particularly suited to making thin devices. Pressure-sensitive QTC switches can be made 70 micrometres thick - about the thickness of a human hair.

QTC is better than switches based on so-called "conducting polymers", because they conduct no electricity until they are pressed, leading to better overall efficiency.

Samsung Electro-mechanics has now incorporated the QTC into the navigation switch familiar on smartphones - in addition to the up, down, left, right and centre button, the up and down functions are pressure-sensitive.

This is useful for scrolling more or less quickly through, for example, a long list of emails.

"That same model can be used in many other ways, like in games: to control how hard I want to jump or run for example," said Peratech's chief executive Philip Taysom.

"Electronics are being given the ability to sense something that we take for granted, which is how much we're touching and applying force," he told BBC News.

Further applications that Peratech is involved with include robotics. While much work has gone into giving robots sensitivity to pressure and touch in their fingers, Mr Taysom said there can now be a push to create robots whose whole surface - rather like humans themselves - is pressure-sensitive.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8504373.stm

Published: 2010/02/09 01:04:36 GMT

'Third-hand smoke' risk warning

Lingering residue from tobacco smoke which clings to upholstery, clothing and the skin releases cancer-causing agents, work in PNAS journal shows.

Berkeley scientists in the US ran lab tests and found "substantial levels" of toxins on smoke-exposed material.

They say while banishing smokers to outdoors cuts second-hand smoke, residues will follow them back inside and this "third-hand smoke" may harm.

Opponents called it a laughable term designed to frighten people unduly.

The scientists say nicotine stains on clothing, furniture and wallpaper can react with a common indoor pollutant to generate dangerous chemicals called tobacco-specific nitrosamines or TSNAs.

" **The real danger is not third-hand smoke but propaganda dressed up as science** "
Simon Clark of the smokers' lobby group Forest

In the tests, contaminated surface exposed to "high but reasonable" amounts of the pollutant nitrous acid - emitted by unvented gas appliances and in car exhaust - boosted levels of newly formed TSNAs 10-fold.

Substantial traces of TSNAs were also found on the inside surfaces of a truck belonging to a heavy smoker.

The researchers say third-hand smoke is an unappreciated health hazard and suggest a complete ban on smoking in homes and in vehicles to eliminate any risk.

Cancer chemicals

Toxic particles from cigarette smoke can linger on surfaces long after the cigarette has been put out, and small children are particularly susceptible because they are likely to breathe in close proximity, or even lick and suck them, they say.

Researcher Lara Gundel, of the Lawrence Berkeley National Laboratory, said: "Smoking outside is better than smoking indoors but nicotine residues will stick to a smoker's skin and clothing.

" **The most important step parents can take to protect their families from the dangers of cigarette smoke is to make their homes and cars smokefree** "
Ed Young of Cancer Research UK

"Those residues follow a smoker back inside and get spread everywhere. The biggest risk is to young children.

"Dermal uptake of the nicotine through a child's skin is likely to occur when the smoker returns and if nitrous acid is in the air, which it usually is, then TSNAs will be formed."

They are now doing more research to better understand what threat, if any, TSNAs pose.

Amanda Sandford of Action on Smoking and Health said: "The harmful effects of second-hand smoke are already well-established but this study adds a new dimension to the dangers associated with smoking and provides further evidence of the need to protect children, in particular, from exposure to tobacco smoke.

"The study shows that the residue of smoke on surfaces represents a potential risk for cancer but so far we don't know how big at risk."

Simon Clark, director of the smokers' lobby group Forest, remained sceptical.

He said: "The dose makes the poison and there is no evidence that exposure to such minute levels is harmful.

"That doesn't seem to matter, though. The aim, it seems, is to generate alarm in the hope that people will be stopped from smoking or will give up.

"The real danger is not third-hand smoke but propaganda dressed up as science. Until the evidence of harm is irrefutable, scientists and campaigners should resist the urge to tell us how to live our lives."

Ed Young of Cancer Research UK said: "This is an interesting piece of research that adds the possibility of an extra level of harm from tobacco smoke.

"There is clear evidence about the harmful effects of second-hand smoke to children, especially in homes and cars.

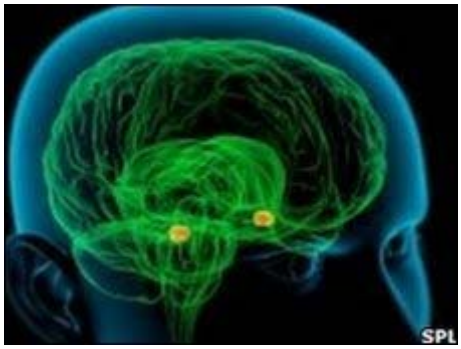
"The most important step parents can take to protect their families from the dangers of cigarette smoke is to make their homes and cars smokefree."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8503870.stm

Published: 2010/02/09 01:04:51 GMT

Brain injury linked to gambling

Californian scientists think they may have discovered the part of the brain which makes people fear losing money.



The study, reported in Proceedings of the National Academy of Sciences, looked at two patients who had damaged their amygdala, deep within the brain.

These patients were less worried about financial losses than the normal volunteers they were compared with.

The scientists say this could translate to how people make decisions in fields ranging from politics to game shows.

'Loss aversion' describes the avoidance of choices which can lead to losses, even when accompanied by equal or much larger gains.

Game behaviour

Lead author, Dr Benedetto De Martino, explains: "Imagine you're on Who Wants to Be a Millionaire.

" **This is a novel and exciting study.** "
John Aggleton, Professor of Psychology at Cardiff University

"You've just answered the £500,000 question correctly and have moved on to the final question.

"You're down to your 50:50 lifeline but don't know the answer.

"If you get it right, you'll win £1 million; if you get it wrong, you'll drop back to £32,000.

"The vast majority of people would take the 'loss averse option' and walk away with £500,000."

This study, carried out by scientists from the California Institute of Technology (Caltech), set out to find out if the amygdala plays a role in causing loss aversion.

It looked at two women who had a rare condition which produced lesions on their amygdalae but no other brain damage.

The lesions prevented them from perceiving, recognising or feeling fear.

The two women were each matched with six control volunteers who had similar age, income and education.

Gambles

The participants were offered a series of gambles to test whether the chance of losing money affected their willingness to gamble.

" **It may be that the amygdala controls a very general biological mechanism for inhibiting risky behaviour when outcomes are potentially negative** "
Dr Benedetto De Martino, University College, London

The study found that healthy volunteers would only opt to gamble if the potential gains were one and a half to two times the size of the potential losses.

But the patients whose amygdalae were damaged would play even if there was a much poorer ratio between gains and losses, and one sometimes played even if the potential loss was greater than the potential gain.

The authors say that a fully functioning amygdala appears to make people more cautious, and afraid of losing money.

"It may be that the amygdala controls a very general biological mechanism for inhibiting risky behaviour when outcomes are potentially negative, such as the monetary loss aversion which shapes our everyday financial decisions," said Dr Benedetto De Martino, who is currently a visiting researcher at University College, London.

He pointed out that loss aversion has been shown in many settings including high stakes game show decisions, financial markets, politics, and also in monkey behaviour.

It probably derives from "a basic evolutionary defence mechanism", he said.

He added that it was helpful to understand its basic biological mechanisms so that policymakers could design policies to address it.

'Elegant experiment'

John Aggleton, Professor of Psychology at Cardiff University, said:

"This is a novel and exciting study. The authors conducted a very elegant and neat experiment.

"The amygdala is an area of the brain that is important for normal emotional responses and for how we perceive our environment. "It plays a subtle role in helping people to learn the attributes of good things and bad things.

"Most people have been found to have a bias against losses, but this study shows very clearly that when the amygdala is damaged, this "loss aversion" disappears."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8504605.stm

Published: 2010/02/09 01:04:13 GMT

Fertile forties pregnancy warning

Experts fear older women are ditching contraception in the mistaken belief that they cannot get pregnant past a certain age.

The Family Planning Association (FPA) believes the message on infertility and age has gone "too far".

Although fertility does wane, women can still fall pregnant well into their thirties, forties and even fifties.

Abortion rates for women aged 40 to 44 match those for the under 16s, figures for England and Wales show.

In 2008, both of these groups had an abortion rate of four per 1,000 women.

" **Whilst the message about fertility declining with age is an important one, it is often overplayed** "
FPA Chief Executive Julie Bentley

There are many reasons why some women opt for an abortion - including birth abnormalities in the baby, which are more common when the mothers are older.

But FPA says its anecdotal evidence suggests some of the abortions are because women wrongly assumed they could not get pregnant because they were too old.

Aimed at women aged 35 and over, the FPA's new campaign 'Conceivable?' reminds women to stay vigilant about unplanned pregnancy and to keep using contraception until after the menopause if they do not wish to become pregnant.

Chief executive of the FPA Julie Bentley said: "Whilst the message about fertility declining with age is an important one, it is often overplayed, alongside disproportionate messaging about unplanned teenage pregnancies.

"It sends an inaccurate message to women and society that only the young fall pregnant and is leading older women to believe their fertility has gone long before it actually has."

Once is enough

She said women should realise it is entirely conceivable that just one night of unprotected sex in your late 30s, 40s and even 50s can end in an unplanned pregnancy.

"Our helpline receives calls from such women, shocked this has happened to them.

"They thought their age would protect them from becoming pregnant."

She said in general all methods of contraception were suitable for the over-35s.

Women aged 30 to 34 continue to have the highest fertility rate - 113.1 live births per 1,000 women.

But the rate among women aged 40 and over has more than doubled since 1988, from 5.1 to 12.6 per 1,000 women, and there were more than 26,000 live births to women in this age group in 2008, figures from the Office for National Statistics show.

Emily James of Marie Stopes International said: "Many older women facing an unplanned pregnancy are completely shocked to find themselves in this position - many assume that their irregular periods are due to menopause, and are surprised to learn that they are in fact pregnant.

"It is vital that women of all ages are provided with the information, support and advice they need when deciding whether or not to continue with an unplanned pregnancy."

Have you been affected by the issues in this story? Send us your comments.

A selection of your comments may be published, displaying your name and location unless you state otherwise in the box below.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8503726.stm

Published: 2010/02/09 01:03:41 GMT

Two futures of the internet: next cold war or up in the clouds

Will the future be cyber-attacks and an uneasy balance of terror or cultural collaboration hosted by Google's servers?

- John Naughton
- The Observer, Sunday 7 February 2010

The Google offices in Beijing. The internet company is reconsidering how it does business there after being targeted in cyber-attacks believed to have been directed by the Chinese authorities. Photograph: Diego Azubel/EPA

"THE FUTURE", WROTE the novelist William Gibson in a justifiably famous aphorism, "is already here: it's just not evenly distributed".

The challenge is to spot those unevenly distributed peeks into our future. The Apple iPad launch provoked a storm of peeking: optimists saw it as a sign that the computer industry had finally got the message that most people can't be bothered with the mysteries of operating systems and software updates and want an information appliance that "just works"; pessimists saw it as a glimpse into an authoritarian world dominated either by governments or a few powerful companies; sceptics saw it as just another product launch.

Last week provided yet another enigmatic glimpse of what may lie in store. The *Washington Post* said Google, still reeling from the sophisticated cyber-attack that allegedly prompted a rethink of its activities in China, had turned to the US National Security Agency for help. The *Post* reported that there are delicate talks on teaming up with the spooks with the goal of "fortifying Google's defences against the kind of espionage-oriented hacking attacks launched from China against it and dozens of other US companies in December".

If you think this is creepy, then join the club. In terms of collective IQ, Google is the smartest company in cyberspace: for five years it's been taking the cleverest graduates from elite universities and the most experienced computer engineers. It's been such a magnet for talent that even Microsoft is enraged. In 2005, for example, an ex-Microsoft engineer named Mark Lucovsky alleged in a sworn statement to a Washington state court that Steve Ballmer, Microsoft's chief executive, became so enraged on hearing that Lucovsky was about to leave Microsoft for Google, that he picked up his chair, and threw it across his office. (Ballmer called this a "gross exaggeration".)

So Google is unlikely to be turning to the NSA for technical advice. Why then is it calling in the spooks? One reason could be that the world's dominant internet company is now in the crossfire of early skirmishes of the next cold war.

This thought was reinforced by *Financial Times* columnist Gideon Rachman. He'd been to the International Institute for Strategic Studies for a briefing on its annual survey, Military Balance. "The thing I found most interesting," he said, "was the confirmation that cyber-security is the hot issue … John Chipman, the head of the IISS, says the institute is about to launch a study of cyber-security which raises all sorts of issues. What if a country's infrastructure could be destroyed as effectively by a cyber-attack as by an invasion of tanks? How do you defend against that? How do you identify the culprits? What does international law have to say – might we have to revise our definitions of what constitutes an act of war?

"Chipman argues, plausibly, that we are now at an equivalent period to the early 1950s. Just as strategists had to devise whole new doctrines to cope with the nuclear age, so they will have to come up with new ideas to cope with the information age."

Another glimpse of a possible future comes from the British Council. A surprising source of such insights, you might think: Oone used to associate the council with cultural imperialism and heritage-fuelled nostalgia. But things have changed. The British Council has got technology. "Learn, share, connect worldwide" is the slogan on its website. It commissioned Charles Leadbeater to think about the cultural implications of "cloud computing" – ie when the network, rather than the PC, becomes the computer.

His report, "Cloud Culture: the future of global cultural relations", is being launched tomorrow with a debate at the ICA (details at http://bit.ly/9ZTSin). It's a well-informed, provocative sketch of a world in which most cultural products will be published online and held in the "cloud" enabled by the huge server farms of Google, Amazon, Microsoft, Apple etc. As a primer on the debate between optimists and pessimists about the cultural implications of ubiquitously available internet access, it'll be hard to beat.

Leadbeater calls himself a "realistic optimist" and thinks a cloud-based approach to cultural relations will build communities of collaboration around shared interests and ideas on an unimaginable scale. As a realistic pessimist, I hope he's right. But I keep coming back to the question: who controls the cloud? And where does the NSA fit into this?

http://www.guardian.co.uk/technology/2010/feb/07/computers-future-cyberattacks-cloud-culture

Ally for the Poor in an Unlikely Corner
By DONALD G. McNEIL Jr.

Andrew Witty is not quite as young or as buff as Anderson Cooper, but he does do interviews in shirtsleeves from the slums of Nairobi and rural hospitals in Uganda.

What makes that unusual is that Mr. Witty is not a roving CNN anchor, but the chief executive of GlaxoSmithKline, the world's second-largest drug company.

Besides being the youngest person in such a post — he was appointed in 2008 at age 43 — he is also making a name for himself by doing more for the world's poor than any other leader of a colossus of Big Pharma.

"I want GSK to be a very successful company, but not by leaving the population of Africa behind," Mr. Witty said in an interview. "In any village hospital, you can see the beds filled with women and babies severely febrile with malaria, staring into space, and you wonder: Who's taking care of the other children? It's so obvious, the damage that's being done."

That tone is still rare in an industry once pilloried for keeping its prices up while millions died. Until a decade ago, all major drug companies treated Africa, Latin America and most of Asia as not worth the trouble of marketing to.

But Mr. Witty, who started as a Glaxo trainee right out of the University of Nottingham, spent 10 years in Africa and Asia, and he was inspired to change that.

A memory "that still makes the hair go up on the back of my neck," he said, was arriving in South Africa just before the 1994 elections, when many feared the country would explode. He was 29, head of the office but often mistaken for an intern, and co-workers advised him to buy a gun and stockpile food in case of civil war. On the eve of the election, he gathered the Johannesburg factory's 300 frightened workers to reassure them that the plant and their jobs would remain, come what might.

Election Day dawned with a bomb blast at the airport — but then blossomed into a festival of racial unity, democracy and victory for Nelson Mandela.

"It was as if the whole country had looked into an abyss and decided: 'You know what? We're not going to jump,' " Mr. Witty said.

That "bonding experience" taught him how resilient Africa could be; and then he was invited to help the Mandela government write its drug and health care policies.

Later, working in China, India, Myanmar (formerly Burma), Pakistan and Vietnam, he found "just unbelievable energy to self-improve, to lift themselves up."

"They deserve their chance," he continued.

Now Glaxo is ranked No. 1 on the Access to Medicine Index created in 2008 by an organization based in the Netherlands that rates pharmaceutical companies on their stances toward the poor much as Transparency International ranks countries on corruption.

Glaxo has cut deals with drug makers like Dr. Reddy's in India and Aspen Pharmaceuticals in South Africa to support their new drugs and jointly market Glaxo brands.

It is teaching Brazil's state vaccine company, Fiocruz, how to brew its new pneumococcal vaccine.

Last year, in a speech to Harvard medical students, Mr. Witty promised to keep the prices of all Glaxo drugs in poor countries to no more than 25 percent of what was charged in rich ones, and to donate one-fifth of all profits made in poor countries toward building their health systems.

Glaxo has built a laboratory in Tres Cantos, Spain, specializing in malaria and neglected diseases. The company put its drugs for neglected diseases into a "patent pool" so researchers can refine them or combine them with those of rivals.

It lends young executives to the governments of poor countries and to the partnerships fighting various diseases.

Since 1998, it has donated one billion doses of albendazole, a worm-killing drug, to prevent the grotesquely swollen legs and scrotums of elephantiasis, or lymphatic filariasis. Mr. Witty promised to quadruple the annual donation and make other gifts.

And just last month, in a speech to the Council on Foreign Relations, he made two new offers.

The company screened its library of two million chemicals for all that attacked malaria, a process that took five technicians a year in a high-biosecurity laboratory because the parasite is too dangerous to run through the routine screening machines.

The 13,500 "hits" they got will all be posted on Web sites, available free to anyone working on malaria. "However," he joked, "if someone says, 'My goodness, I've just found a new cardiac medication,' well, that's a different conversation."

Also, he promised that if the malaria vaccine the company had been working on for 23 years passed its clinical trials, it would be priced at only 5 percent over the cost of making it. The company will not try to recoup the huge research costs, which have been shared by the United States Army and the Bill and Melinda Gates Foundation.

Mr. Witty's plans have been widely praised.

While other companies let some researchers search their libraries, Glaxo has set a new standard for openness, said Timothy Wells, chief scientific officer of the Medicines for Malaria Venture, which seeks new drugs.

"At most companies, I can get in to talk to the head of R. & D.," Dr. Wells said, "but without the C.E.O. being visibly behind it, people aren't able to commit. This will probably speed up the process by several years."

"Bill Gates can get C.E.O.'s together," he added, "but that's not enough. People respected by their peers have to put their skins on the line."

Dr. Bernard Pécoul, executive director of the Drugs for Neglected Diseases Initiative, said that drug companies were finally helping the poor but that Glaxo was "more innovative."

And Sophia Tickell, who in 2001 led Oxfam in accusing the whole industry, and Glaxo in particular, of "waging an undeclared war on the poor," trusted Mr. Witty's sincerity enough to become a paid Glaxo adviser.

When he introduced her to the board, she said, he opened by saying: "This is Sophia. She wrote the report, and we deserved it."

Mr. Witty still has critics. Daniel Berman, who a decade ago co-founded Doctors Without Borders' Access Campaign, said that Glaxo's work on transferring vaccine technology to middle-income countries was "still a lot of smoke and mirrors" and could go faster, that the Tres Cantos lab "still doesn't have a big enough budget to make a difference" and that putting drugs for neglected diseases into a patent pool was "a bit silly" since no one fought for the patent rights anyway.

"If they were seriously interested in patent pools," Mr. Berman said, echoing a criticism voiced by Oxfam as well, "they'd try out the Unitaid one."

(Unitaid, a European agency using an airline ticket tax to buy drugs for poor countries, has offered to oversee a pool of patents on AIDS drugs so new combination pills can be made cheaply.)

Mr. Witty counters that AIDS is not just a disease of the poor and that Glaxo needs to keep making profits in rich and middle-income countries. The company lets Indian and African counterparts make its drugs without paying royalties, and they produce four times as many pills as Glaxo does.

The company, Mr. Witty said, is "very much aligned with Unitaid's goal and now in cordial negotiations with them."

"But we want to hammer out the details," he continued.

In contrast to his aloof and abrasive predecessor, J. P. Garnier, Mr. Witty, a father of two teenagers, moved his office atop the London headquarters down to the ground floor, and he sometimes eats in the cafeteria or runs five miles at lunch.

Many employees love his plans, he said, because it makes them feel they are helping the world.

How shareholders feel will presumably depend on how the stock does during his tenure.

Reactions from his rivals at other pharmaceutical companies, he said, "run the full spectrum from very complimentary to 'What are you doing? You're undermining a critical piece of the business model.' "

In the end, Mr. Witty said, "I'm in charge of an organization that can actually make a difference for people in the third world, and I am not going to be the person who, after X years, sits back and says, 'Oh, I wish I'd done more.' "

http://www.nytimes.com/2010/02/09/health/09prof.html?nl=health&emc=healthupdateema1

Risks: Study Looks at Serotonin and SIDS Deaths
By RONI CARYN RABIN

Babies who die of sudden infant death syndrome may have low levels of serotonin, a brain chemical involved in regulating breathing and other vital functions, a new study suggests.

Harvard researchers who made the discovery said that it took them a step closer to understanding why babies who appeared to be perfectly healthy might die suddenly, and that it could eventually lead to development of a screening test to identify at-risk infants.

"This says SIDS is a disease process," said Dr. Hannah C. Kinney, a professor of pathology at Harvard Medical School and senior author of the paper, published Feb. 3 in The Journal of the American Medical Association. "It's not a bolt out of the blue; it's not a mystery. You can study this problem with the scientific method, and you can make headway."

As part of the study, researchers analyzed tissue samples from infants who died of SIDS and a smaller number who died of other causes. They found that serotonin levels in the brain stem were 26 percent lower in the SIDS group.

The SIDS babies also had lower levels of an enzyme involved in synthesizing serotonin.

Dr. Kinney said the discovery did not alter the "back to sleep" message that infants should be put to sleep on their back.

http://www.nytimes.com/2010/02/09/health/research/09risk.html?ref=research

Doctors, Patients and a Clash of Priorities

By RONI CARYN RABIN

High blood pressure is often a top priority for doctors. But pain and depression may be more pressing to their patients.

A new study that surveyed health care providers and their patients with both diabetes and high blood pressure found that most of the time they agreed on at least one or two of the three most important health problems affecting the patient.

But in almost one-third of the cases, the provider's top three concerns did not include the top priority of the patient, the survey found, especially if that item was pain or depression, said Dr. Donna M. Zulman, a Veterans Affairs researcher who was lead author of the study.

The paper was published online on Feb. 2 in The Journal of General Internal Medicine.

"The bad news is that the likelihood of general agreement decreased when the patient was in poor health," said Dr. Zulman, who is also an internist in the Robert Wood Johnson Clinical Scholars program at the University of Michigan. While providers focus on diabetes and high blood pressure because of the serious long-term complications, she said, "patients in poor health are more likely to prioritize symptoms they're experiencing on a day-to-day basis."

The findings may reflect a lack of awareness about how important it is for diabetics to control their blood pressure, Dr. Zulman said, adding that the message to patients is that they must communicate clearly and "not assume their health care provider shares their priorities."

http://www.nytimes.com/2010/02/09/health/research/09perc.html?ref=research

H.I.V. and Herpes: Treating Herpes Doesn't Reduce Chance That AIDS Virus Will Spread, Study Finds

By DONALD G. McNEIL Jr.

Treating herpes in people who are also infected with H.I.V. does not reduce the chances that they will pass on the AIDS virus, according to a new study.

The results were a surprise, said the lead author, Dr. Connie Celum, a professor of global health at the University of Washington. For unknown reasons, the herpes drug acyclovir lowers the level of AIDS virus in the blood. Still, Dr. Celum said, "no one knew whether that would be enough to reduce H.I.V. transmission."

For the study, which appeared last week in The New England Journal of Medicine, researchers at 14 sites across Africa screened 50,000 couples to find 3,400 in which one partner was infected with both viruses and both partners agreed to remain in the study for two years.

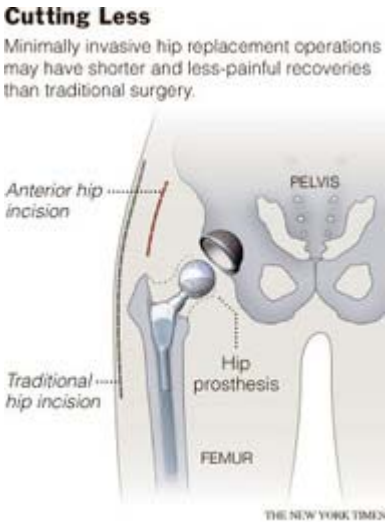
All participants were given condoms; half got acyclovir, and half got a placebo. Those on acyclovir had only half as many genital sores and had less AIDS virus in their blood.

Nonetheless, those in both groups transmitted the AIDS virus to their partners at the same rate. (Viral testing showed that almost 30 percent were actually infected by other partners, but those cases were dropped from the study.) Giving condoms and advice did lower overall infection rates, however.

While acyclovir is cheaper than antiretroviral drugs and has fewer side effects, "new strategies are needed" to stop AIDS transmission, the authors concluded.

http://www.nytimes.com/2010/02/09/health/09glob.html?ref=research

Less Invasive Hip Surgeries Make Inroads
By JANE E. BRODY



Hip replacement is one of the most successful operations in all of medicine, which prompts many orthopedic surgeons to think, as one leader in the field put it, "Why change something that doesn't need fixing?"

But that leader, Dr. Robert Berghoff; his colleagues at Arizona Orthopedic Associates in Phoenix; and other orthopedic surgeons around the country believed that improvements were possible, especially with regard to reducing complications and speeding recovery.

The technique these surgeons use is called anterior hip replacement, one of several minimally invasive operations that are associated with a shorter hospital stay, smaller incision, less trauma to muscles, less pain and blood loss, reduced risk of dislocation after surgery, faster healing and a quicker return to normal activities.

"The morning after surgery I was able to walk without a walker or even a cane and could put my full weight on the operated side," Jack White, a 71-year-old personal trainer from Paradise Valley, Ariz., said in an interview. "The next day I walked 50 yards without a limp and was able to go home, where I did physical therapy five days a week for two weeks. On Day 5, I walked a mile and a half, and in Week 4, I taught my aerobics class and played 18 holes of golf with no pain and no problem."

The operation was introduced in the United States more than two decades ago by Dr. Joel M. Matta of the St. John's Health Center in Santa Monica, Calif., who also helped design a special operating table to simplify the procedure.

Another minimally invasive form of hip replacement, the PATH technique, was developed by a Los Angeles orthopedist, Dr. Brad L. Penenberg.

Dr. Patrick Meere of New York University Langone Medical Center and the Hospital for Joint Diseases in New York tells me this method has the same advantages as the anterior approach, results in no activity limitations and also offers a safety net: If anything goes wrong during the procedure, the problem can be repaired without having to do a more extensive operation.

Traditional Method

Nearly 200,000 hip replacements are performed each year in the United States, and the number continues to grow as the population ages. There is no age limit for this elective operation unless an underlying health problem makes any operation too risky.

The usual reasons for hip replacement are osteoarthritis, rheumatoid arthritis and traumatic arthritis, all of which can cause pain and stiffness that limit mobility and the ability to perform activities of daily living. Most patients try less drastic measures — physical therapy, medications (pain relievers, anti-inflammatory drugs and glucosamine supplements), injections of hyaluronic acid and walking aids — before deciding that surgery is their best hope for escaping chronic pain and disability.

To appreciate the potential benefits of minimally invasive methods, it helps to know how hip replacements are usually done.

General or spinal anesthesia is used for the operation, which typically takes one to two hours. An incision 10 to 12 inches long is made through the muscles on the side of the hip to expose the hip joint, and the diseased bone tissue and cartilage are removed. An artificial socket is then implanted into the pelvic bone and a metal stem is inserted into the thigh bone, the top of which is replaced by a metallic ball to create a ball-and-socket joint that mimics the function of a natural hip joint.

The average hospital stay is four or five days, followed in most cases by extensive rehabilitation. Patients are told not to cross their legs or bend at the hip more than 90 degrees after surgery — in some cases indefinitely, because these motions can cause dislocation of the replaced joint that requires a repeat operation.

Possible complications of the surgery include blood clots, infection, fracture and a change in leg length. Possible delayed complications include dislocation of the new joint, breaking or loosening of the prosthesis and stiffening of the tissues around the joint. Although modern materials have extended the life of implants to 20 years or so, they can eventually wear out and require replacement.

Patients should prepare ahead for limitations associated with postoperative recovery. The American Academy of Orthopedic Surgeons suggests these home modifications: safety bars or handrails for the shower or bath; a raised toilet seat and shower bench; a long-handled sponge and shower hose; handrails on all stairways; removal of all loose carpets and electrical cords in walking areas; a dressing stick, sock aid and long-handled shoe horn; a reacher to help you grab objects without bending or climbing; a stable chair with firm cushion, back and arms; and firm pillows for chairs, sofas and cars so you can sit with knees lower than your hips.

You might also rent a commode if there is no bathroom on the first floor; arrange for help with cooking, shopping, bathing and laundry for several weeks; prepare and freeze individual meals in advance of surgery; and place frequently used kitchen, bathroom and clothing items within easy reach.

The Minimal Approach

Studies comparing long-term results of minimally invasive hip replacement with more traditional surgery have had mixed results, and all forms of hip replacement have benefited from improved anesthetic and pain management techniques. Surgeons who routinely use less invasive methods maintain that there are decided advantages for most patients, even though the operation itself can take somewhat longer.

Perhaps most important is that major muscles in the buttocks and thigh that help to stabilize the hip joint are not cut, reducing the risk of dislocation and speeding recovery. Patients spend less time in the hospital and, like Mr. White, return to normal life more quickly.

Still, Dr. Berghoff emphasized, it takes time to become adept at the procedure, as with any complex surgery. In choosing a surgeon, ask how many of the operations the surgeon has done using the proposed technique and with what results.

Regardless of the type of operation, as Mr. White found, it helps to have supporting muscles as strong as possible before surgery, perhaps through several sessions with a physical therapist if the patient's condition allows it.

http://www.nytimes.com/2010/02/09/health/09brod.html?ref=research

Crestor Wins Approval as a Drug to Prevent Heart Disease

By REUTERS

AstraZeneca won approval Monday to promote its cholesterol fighting drug Crestor for preventing heart disease in a vast new market of people with healthy cholesterol but other heart risks.

Crestor won approval from the Food and Drug Administration for reducing the risk of heart attacks, strokes, bypass operations and artery-clearing procedures in people with high levels of C-reactive protein in addition to at least one other risk factor. That clears the way for the drug for millions of people who are not typically prescribed cholesterol drugs now.

C-reactive protein, or C.R.P., is a sign of inflammation associated with heart disease. Patients should be men at least 50 years old or women at least 60, the F.D.A. said.

The approval was based on data from a nearly 18,000-patient study, called Jupiter, financed by AstraZeneca.

The study tested Crestor versus a placebo in middle-age people with healthy cholesterol, but high levels of C.R.P. The rate of major cardiovascular problems was 1.6 percent for patients treated with Crestor compared with 2.8 percent with a placebo, the F.D.A. said.

An F.D.A. advisory panel that reviewed the Jupiter results in December backed wider use but voiced concern that doctors might use Crestor too broadly in patients with low risk. F.D.A. reviewers had told the panel up to 6.5 million Americans meet the criteria used in the Jupiter study.

On Monday, the F.D.A. said doctors "must interpret the results of the Jupiter trial with caution."

For example, there was no evidence Crestor helped patients with high C.R.P. but no traditional risk factors like high blood pressure, low HDL or "good" cholesterol, smoking or a family history of early heart disease, the F.D.A. said.

Wider approval for Crestor is likely to increase sales of the drug, but industry analysts say the size of the opportunity is uncertain because of the impending arrival of cheaper generic versions of the rival Lipitor from Pfizer in late 2011.

http://www.nytimes.com/2010/02/09/business/09astra.html?ref=research

Insulin Study Could Lead to New Dosage Devices
By NATASHA SINGER

The results of a new study on managing juvenile diabetes may give hope to millions of parents in this country and abroad who typically wake up several times a night to make sure their children's blood sugar levels have not dropped into the danger zone.

And the research, published Friday in The Lancet, a British medical journal, could help spur medical device companies to more quickly develop technology based on the study's underlying concept.

The study reported that a novel computer algorithm that analyzed children's glucose levels and recommended frequent adjustments in their insulin doses was better at preventing very low glucose overnight than a standard diabetes management system.

That standard system involved a continuous glucose monitor that operated separately from a preprogrammed insulin pump — an approach now used by many of the estimated three million people nationwide who have Type 1 diabetes. Type 1 diabetes, also known as juvenile diabetes, is a disease that often develops early in life and is separate from Type 2 diabetes, which often stems from obesity.

Very low glucose, called hypoglycemia, is a condition that poses risks for people with either form of diabetes, potentially causing shakiness, dizziness, seizures, coma or even death. But it is a particular concern among children on insulin because their blood sugar levels tend to fluctuate more widely, researchers said.

No children in the study who were treated with the computer-assisted system experienced very low blood sugar overnight. But there were nine instances of very low blood sugar among children who had the standard treatment, according to the study, conducted by researchers in Britain at the University of Cambridge.

"This is an important step in diabetes control because it shows that, with this system, people can sleep safely with minimized risk of hypoglycemia," said Dr. Eric Renard, a professor of diabetology at Montpellier University Hospital in Montpellier, France.

Dr. Renard, whose commentary accompanied the study in The Lancet, has been a consultant and speaker for several makers of diabetic products, he said.

Industry analysts have estimated that 10 to 15 percent of Americans with Type 1 diabetes — perhaps 400,000 of them — use either a continuous glucose monitor or an insulin pump, or in some cases both.

Over the last decade, the makers of medical devices have developed techniques that have widened diabetes management options beyond pricking the finger several times a day to test blood glucose levels. Companies like DexCom in San Diego now make small continuous glucose monitors whose sensors can be embedded in the skin. And Animas, a division of Johnson & Johnson, makes programmable pumps the size of a cellphone that administer insulin doses through a tiny implantable catheter.

These new-generation devices represent a significant advance over older products, said Aaron J. Kowalski, the assistant senior vice president of glucose control research at the Juvenile Diabetes Research Foundation in Manhattan, one of the largest nonprofit patient advocacy and research groups for diabetes.

Even so, Dr. Kowalski said, using separate devices that are not designed to work in concert poses limits to treatment, particularly overnight. If a diabetic person's blood sugar drops during the night and the glucose monitor alarm goes off, for example, that person may not wake up and the preprogrammed pump, operating separately, could continue to deliver insulin, making the problem worse, Dr. Kowalski said. (His group was one of the sponsors of the Lancet study.)

Researchers in Europe and the United States have been racing to develop a fully automated system for Type 1 diabetes that would wirelessly connect an external glucose monitor with an insulin delivery device. Based on algorithms like the ones used in the Lancet study, the devices would continually monitor glucose levels, calibrate insulin dosages and then dispense insulin in real time — automating a delivery task performed by a nurse in the study.

Researchers call such a hypothetical integrated system an "artificial pancreas" because it would mimic the way a healthy pancreas works, sensing glucose and dispensing insulin in the right dose at the right time. The goal is a portable system that could be worn on a belt and would be no larger than a cellphone.

Last month, as part of an effort called the Artificial Pancreas Project, the Juvenile Diabetes Research Foundation announced an $8 million partnership with Animas to develop a first-generation combined system. Meanwhile the European Union has just started its own project, called Artificial Pancreas at Home, which involves a grant of 10.5 million euros to research teams across Europe to create a prototype combined device over the next four years, Dr. Renard said.

The new study in The Lancet, proponents say, represents a proof-of-concept milestone in the quest to develop such a system.

"The significance is in showing that the existing devices, which are available commercially, can be combined to create the first version of an artificial pancreas," said Dr. Roman Hovorka, the lead author of the study.

Dr. Hovorka, a principal research associate in pediatrics at Cambridge, said he had been a consultant or speaker for several makers of diabetes products.

Although the Lancet study was small — only 17 children completed the entire protocol — it is significant because it demonstrated that a computer algorithm could safely interpret glucose data and calculate appropriate insulin doses for a pump, he said.

The study not only indicated that the algorithm system prevented very low glucose overnight, Dr. Hovorka said, but it also indicated that the experimental system was better able to keep blood glucose in an acceptable range.

After midnight, about 80 percent of the measured glucose levels fell in a target range in children treated with the computer-adjusted system — compared to only 35 percent in the target range for those treated with a standard preprogrammed pump system, according to the study.

Still, while the overall results were statistically significant, the study was not large enough to attain statistical significance in each of its separate arms. Those branches of the study examined how children fared after eating meals or after exercising — factors which can affect glucose levels.

And the experimental combined system itself was not fully automated. To ensure that the experimental algorithm did not recommend unsafe doses, a nurse read the computer-generated dosing suggestions and then adjusted the patients' insulin pumps.

Indeed, even if device makers are able to develop fully automated prototypes of combination systems, they are likely to face regulatory hurdles, analysts said, and would have to factor in product liability concerns.

"This is something that companies have been striving to do for years, and as computer chip technology evolves, it gets closer," said Rick Wise, an analyst at Leerink Swann, a health care investment bank. "But you have to appreciate how exquisitely reliable an artificial pancreas would have to be to read glucose correctly and dispense insulin correctly."

http://www.nytimes.com/2010/02/05/business/05diabetes.html?ref=research

Will You Be E-Mailing This Column? It's Awesome

By JOHN TIERNEY

Sociologists have developed elaborate theories of who spreads gossip and news — who tells whom, who matters most in social networks — but they've had less success measuring what kind of information travels fastest. Do people prefer to spread good news or bad news? Would we rather scandalize or enlighten? Which stories do social creatures want to share, and why?

Now some answers are emerging thanks to a rich new source of data: you, Dear Reader.

Researchers at the University of Pennsylvania have intensively studied the New York Times list of most-e-mailed articles, checking it every 15 minutes for more than six months, analyzing the content of thousands of articles and controlling for factors like the placement in the paper or on the Web home page.

The results are surprising — well, to me, anyway. I would have hypothesized that there are two basic strategies for making the most-e-mailed list. One, which I've happily employed, is to write anything about sex. The other, which I'm still working on, is to write an article headlined: "How Your Pet's Diet Threatens Your Marriage, and Why It's Bush's Fault."

But it turns out that readers have more exalted tastes, according to the Penn researchers, Jonah Berger and Katherine A. Milkman. People preferred e-mailing articles with positive rather than negative themes, and they liked to send long articles on intellectually challenging topics.

Perhaps most of all, readers wanted to share articles that inspired awe, an emotion that the researchers investigated after noticing how many science articles made the list. In general, they found, 20 percent of

articles that appeared on the Times home page made the list, but the rate rose to 30 percent for science articles, including ones with headlines like "The Promise and Power of RNA." (I swear, the science staff did nothing to instigate this study, but we definitely don't mind publicizing the results.)

"Science kept doing better than we expected," said Dr. Berger, a social psychologist and a professor of marketing at Penn's Wharton School. "We anticipated that people would share articles with practical information about health or gadgets, and they did, but they also sent articles about paleontology and cosmology. You'd see articles shooting up the list that were about the optics of deer vision."

To make sense of these trends in "virality," the Penn researchers tracked more than 7,500 articles published from August 2008 to February 2009. They assessed each article's popularity after controlling for factors like the time of day it was published online, the section in which it appeared and how much promotion it received on the Web home page.

A random sample of 3,000 of these articles was rated by independent readers for qualities like providing practical value or being surprising. The researchers also used computer algorithms to track the ratio of emotional words in an article and to assess the relative positivity or negativity.

The computer textual analysis could identify "affect-laden" articles like "Redefining Depression as Mere Sadness" or "When All Else Fails, Blaming the Patient Often Comes Next." It distinguished positive articles like "Wide-Eyed New Arrivals Falling in Love With the City" from downers like "Germany: Baby Polar Bear's Feeder Dies."

More emotional stories were more likely to be e-mailed, the researchers found, and positive articles were shared more than negative ones. Longer articles generally did better than shorter articles, although Dr. Berger said that might just be because the longer articles were about more engaging topics. (The best way to test that, he said, would be for The Times to run shorter and longer versions of the same article that would be seen by different readers.)

Surprising articles, like one about free-range chickens on the streets of New York, were also more likely to be e-mailed — which was a hardly a surprising discovery, of course. But the researchers also kept finding popular articles with a quality that went beyond surprise.

"If I went into my classroom dressed up like a pirate, that would be surprising, but it wouldn't be awe-inspiring," Dr. Berger said. "An article about square watermelons is surprising, but it doesn't inspire that awed feeling that the world is a broad place and I'm so small."

Building on prior research, the Penn researchers defined the quality as an "emotion of self-transcendence, a feeling of admiration and elevation in the face of something greater than the self."

They used two criteria for an awe-inspiring story: Its scale is large, and it requires "mental accommodation" by forcing the reader to view the world in a different way.

"It involves the opening and broadening of the mind," write Dr. Berger and Dr. Milkman, who is a behavioral economist at Wharton.

"Seeing the Grand Canyon, standing in front of a beautiful piece of art, hearing a grand theory or listening to a beautiful symphony may all inspire awe. So may the revelation of something profound and important in something you may have once seen as ordinary or routine, or seeing a causal connection between important things and seemingly remote causes."

The motivation for mailing these awe-inspiring articles is not as immediately obvious as with other kinds of articles, Dr. Berger said. Sharing recipes or financial tips or medical advice makes sense according to classic economic utility theory: I give you something of practical value in the hope that you'll someday

return the favor. There can also be self-interested reasons for sharing surprising articles: I get to show off how well informed I am by sending news that will shock you.

But why send someone an exposition on quantum mechanics? In some cases, it, too, could be a way of showing off, particularly if you accompanied the article with a note like, “Perhaps this will amuse, although of course it’s a superficial treatment. Why can’t they use Schrödinger’s full equation?”

But in general, people who share this kind of article seem to have loftier motives than trying to impress their friends. They’re seeking emotional communion, Dr. Berger said.

“Emotion in general leads to transmission, and awe is quite a strong emotion,” he said. “If I’ve just read this story that changes the way I understand the world and myself, I want to talk to others about what it means. I want to proselytize and share the feeling of awe. If you read the article and feel the same emotion, it will bring us closer together.” (Go to nytimes.com/tierneylab to discuss your motives for e-mailing articles.)

The Penn researchers found evidence of readers’ sharing other emotions, too, like anxiety — which, based on the old “fear sells” theory of journalism, might be expected to be the most influential emotion on readers. But of all the variables studied, Dr. Berger said, awe had the strongest relationship with an article making the most-e-mailed list, and that finding strikes me as a high compliment to the Times audience.

In fact, Dear Reader, you could consider this new study to be firm scientific evidence of your own awesomeness. And if you want to share that feeling with anyone, you know what to do next.

http://www.nytimes.com/2010/02/09/science/09tier.html?ref=science

When to Worry if a Child Has Too Few Words

By PERRI KLASS, M.D.

There is nothing simple about speech, and there is nothing simple about speech delay — starting with the challenge of diagnosing it.

Every pediatrician knows the frustration of trying to quantify the speech and language skills of a screaming toddler. How many words can he say? Can she put two or more words together into a sentence? Can people besides you understand him when he talks? Questions like these, put to the parents, are the quick and somewhat crude yardsticks we often use.

Crude or not, the assessment is crucial: the earlier it is made, the earlier the speech-delayed child can get some help, and the earlier the help, the better the prospects.

"The physician who understands delayed speech understands child development," said Dr. James Coplan, a neurodevelopmental pediatrician in Rosemont, Pa., who created the Early Language Milestone Scale to measure children's language from birth to age 3.

Guidelines by age can be found on the Web site of the American Speech-Language-Hearing Association: asha.org/public/speech/development/chart.htm.

"Children within the first year start to understand much of what they hear around them," said Diane R. Paul, the group's director of clinical issues in speech-language pathology. One-year-olds, she continued, "start to use single words and follow simple directions and point to body parts and listen to simple stories." By about 2, they start putting words together; by 3, they should be using sentences of three words at the very minimum.

The early utterances may be simple, but what produces them is very complex. When a child is not meeting those milestones, there can be a multitude of reasons. Dr. Coplan, who is also the author of "Making Sense of Autistic Spectrum Disorders" (Random House, 2010), says he looks at speech delay in a very broad context, from cognition to communication. Is it purely a problem with speech and language, or is there some more global delay? Has something gone awry in the child's social connections?

The first question to ask is whether the child can hear. Nowadays, all newborns have their hearing screened before they leave the nursery, but later testing can pick up progressive or acquired hearing loss.

Next question: What about the rest of the child's development? Speech and language delay can be one way parents and pediatricians first notice more global developmental delay.

"You'll see delayed receptive language, delayed use of visual skills like pointing, adaptive skills like using a spoon or using a crayon," Dr. Coplan said. "An 18-month-old not following commands, not using a spoon to dig with, now you're looking at global delay."

Speech and language issues can also be early clues to neurodevelopmental disorders, including the various forms of autism. Not all children with autism will have delayed speech, though often they are not

using their words to communicate; such a child may have memorized the alphabet, Dr. Coplan said, but without ever learning Mama or Dada.

If the child's hearing and development are fine, one more question to consider is environment. Is anyone talking to this baby? Is something getting in the way — maybe an exceptionally chaotic household, maybe a severely depressed parent? Speech and language development requires stimulation.

Pediatricians have been faulted in the past for dragging our feet in making speech-delay diagnoses, but times have changed; Dr. Coplan credited parent advocacy and the federally mandated early intervention program, which makes it possible for children younger than 3 to get a free evaluation.

"I think physicians, now that they have somewhere they can send children, are much more prone to do so, instead of saying, 'We'll wait and see, wait and see,' " he said. "I don't encounter the horror stories I would hear 20, 30 years ago, when parents would say, 'We came over our doctor's objections.' "

Still, as a primary care pediatrician, I have not always managed brilliantly with parents. I once took care of a little boy about whom I worried more and more. In the exam room, he seemed without normal communication skills; I was increasingly sure that he was on the autistic spectrum.

I didn't think he was really learning words, but I worried much more because as far as I could tell, he never made eye contact, never responded in any clear way to anything his parents said or did, because he seemed disconnected in some fundamental way.

His parents shrugged off my concerns and refused all referrals. When he was home with his grandmother, they insisted, he was able to communicate perfectly. He didn't need any help.

In that case, I had the diagnosis right, but my own communication skills were not up to the challenge. And then there were the parents I reassured: she may not be talking as much as her sister did at that age, but she is saying much more than the minimum for a 2-year-old, she understands everything you say to her and she can follow complex commands. Let's wait and watch, let's give her time. Did I get that one right?

Pediatricians are reminded again and again not to be casual about delays in speech and language — not to shrug and say boys just talk later than girls, or younger siblings talk later than older siblings. Such factors may contribute to normal variation, but they shouldn't be used to explain why a child doesn't meet essential milestones.

And as every pediatrician knows, the real stalwarts in this story — and the real experts — are the speech and language pathologists.

Dr. Paul offered general tips to parents who want to enhance their children's speech and language skills: "Talk to your child about what they're focused on. Read to your child often. If they're in a bilingual home, speak to the child and read to the child in the language that you're most comfortable with. Speak clearly and naturally and use real words. Show excitement when the child speaks."

And listen to what your child is telling you.

http://www.nytimes.com/2010/02/09/health/09klass.html?nl=health&emc=healthupdateema1

Soft Drink Consumption May Markedly Increase Risk of Pancreatic Cancer

A new study found that consuming two or more soft drinks per week increased the risk of developing pancreatic cancer by nearly twofold compared to individuals who did not consume soft drinks. (Credit: iStockphoto/Jill Chen)

ScienceDaily (Feb. 9, 2010) — Consuming two or more soft drinks per week increased the risk of developing pancreatic cancer by nearly twofold compared to individuals who did not consume soft drinks, according to a report in *Cancer Epidemiology, Biomarkers & Prevention*, a journal of the American Association for Cancer Research.

Although relatively rare, pancreatic cancer remains one of the most deadly, and only 5 percent of people who are diagnosed are alive five years later.

Mark Pereira, Ph.D., senior author on the study and associate professor in the School of Public Health at the University of Minnesota, said people who consume soft drinks on a regular basis, defined as primarily carbonated sugar-sweetened beverages, tend to have a poor behavioral profile overall.

However, the effect of these drinks on pancreatic cancer may be unique.

"The high levels of sugar in soft drinks may be increasing the level of insulin in the body, which we think contributes to pancreatic cancer cell growth," said Pereira.

For the current study, Pereira and colleagues followed 60,524 men and women in the Singapore Chinese Health Study for 14 years. During that time, there were 140 pancreatic cancer cases. Those who consumed two or more soft drinks per week (averaging five per week) had an 87 percent increased risk compared with individuals who did not.

No association was seen between fruit juice consumption and pancreatic cancer.

Pereira said that these results from Singapore are likely applicable to the United States.

"Singapore is a wealthy country with excellent health care. Favorite pastimes are eating and shopping, so the findings should apply to other western countries," said Pereira.

Susan Mayne, Ph.D., associate director of the Yale Cancer Center and professor of epidemiology at the Yale School of Public Health, said these study results are intriguing but have some key limitations that should be considered in any interpretation.

"Although this study found a risk, the finding was based on a relatively small number of cases and it remains unclear whether it is a causal association or not. Soft drink consumption in Singapore was associated with several other adverse health behaviors such as smoking and red meat intake, which we can't accurately control for," said Mayne, an editorial board member of Cancer Epidemiology, Biomarkers & Prevention.

Pereira points out that the findings are biologically plausible, held up in non-smokers, remained similar after taking other dietary habits into account and are consistent with findings in Caucasian populations.

Story Source:

Adapted from materials provided by American Association for Cancer Research.

Journal Reference:

1. Noel T. Mueller, Andrew Odegaard, Kristin Anderson, Jian-Min Yuan, Myron Gross, Woon-Puay Koh, and Mark A. Pereira. **Soft Drink and Juice Consumption and Risk of Pancreatic Cancer: The Singapore Chinese Health Study**. *Cancer Epidemiology Biomarkers & Prevention*, 2010; 19 (2): 447 DOI: 10.1158/1055-9965.EPI-09-0862

http://www.sciencedaily.com/releases/2010/02/100208091924.htm

Fundamental Shift in How Biologists Perceive Relationship Between Evolution and Ecology

Biologist Ronald Bassar of UC Riverside hunts for guppies in a stream in Trinidad. (Credit: Sonya Auer, UC Riverside.)

ScienceDaily (Feb. 9, 2010) — Biologists have known for long that ecology, the interaction between organisms and their environment, plays a significant role in forming new species and in modifying living ones. The traditional view is that ecology shapes evolution. The environment defines a template and the process of evolution by natural selection shapes organisms to fit that template.

Some specialized theory, a few laboratory experiments and studies of natural populations suggest, however, that evolutionary processes reciprocate by influencing ecology in turn.

Now a team of biologists presents evidence that ecology and evolution are indeed reciprocally interacting processes, presenting a fundamental shift in our understanding of the relationship between evolution and ecology.

"Ecology for the most part ignores evolution because organisms are treated as constants," said David Reznick, an evolutionary biologist at the University of California, Riverside, who led the study. "This does not mean that ecologists don't believe in evolution. It means the general assumption is that ecological interactions happen on such a short time scale in comparison to evolution that evolution can be ignored -- similar to the way physicists can often safely ignore relativity in the majority of their experiments.

"Our results represent a first significant step in showing that evolution cannot be ignored when studying ecological interactions. In earlier work, we had shown that guppies, our study organism, can evolve very rapidly. In this new study we quantify the ecological consequences of such rapid adaptation."

Study results appear this week in the online early edition of the *Proceedings of the National Academy of Sciences*.

Reznick's team compared guppies -- small freshwater fish that have been the subject of long-term studies -- that had adapted to two different types of stream communities in Trinidad. One stream community had a diverse group of fish species, some of which were serious predators on guppies. The other type of community included guppies and just one or a few non-predatory species.

Previously, Reznick and colleagues had established that predators cause a substantial increase in guppy mortality rates, resulting in guppies that are younger at maturity, produce more babies, and display different behavior, escape abilities and body shapes.

In the new experiments, the researchers collected guppies from the two different types of communities, and quantified their impact on the stream ecosystem by placing them in replicate, artificial streams built alongside a natural stream. The researchers chose this location for the artificial streams so that they could divert water from a spring that normally flowed into the stream in such a way that it first flowed through the artificial streams, emptying later into the natural stream.

Next, they seeded the artificial streams with organisms such as insect larvae from the natural stream so that all artificial streams had similar ecosystems at the start of the experiment.

They found that guppies from the two types of fish communities had substantially different impacts after only four weeks on the structure and function of their ecosystems.

"Guppies from the more diverse fish communities ate more insect larvae while the low-predation guppies -- guppies from the simple fish communities -- ate more algae," said Ronald Bassar, a graduate student in Reznick's lab and the first author of the research paper. "These differences in diet resulted in the artificial streams with guppies from the diverse communities having substantially more algae and fewer invertebrates than streams stocked with guppies from the simple communities.

"There were corresponding differences in how and at what rate nutrients, like nitrogen or phosphorus, were recycled. The streams with high-predation guppies -- guppies from the more diverse fish communities -- had less plant production and oxygen consumption, a slower breakdown of leaves that had fallen into the water and a slower accumulation of detritus, the breakdown product of leaves."

The researchers found, too, that their findings from their experiments in the artificial streams mirrored their observations in guppies across natural stream communities in Trinidad.

"By doing our experiments in the artificial streams we are able to pin down guppies as a likely cause of what we see in the natural streams," Bassar said. "The experiments show that local adaptation causes the evolution of differences in diet, which, in turn, causes differences in ecosystem structure. Our next step is to characterize how this changed ecosystem, in turn, shapes how the guppies adapt to it."

The National Science Foundation supported this research as part of a five year, multi-investigator grant funded by the Frontiers in Integrative Biological Research initiative.

Story Source:

Adapted from materials provided by University of California - Riverside.

http://www.sciencedaily.com/releases/2010/02/100201171639.htm

'Boutique' Fish Farms Created for Ugandans to Combat Lake Victoria's Depleted Fish Supplies

Prof. Berta Sivan in Uganda (Credit: Image courtesy of Hebrew University of Jerusalem)

ScienceDaily (Feb. 9, 2010) — In a unique project to combat depleted fish supplies in Lake Victoria, researchers from the Hebrew University of Jerusalem and Makerere University in Kampala, have established 'boutique' fish farms in small villages around the Lake's shore in Uganda.

Predators

Local fishermen used to fish carp and perciform fish near the shores of the lake, as food for their families. But fifty years ago, the Nile Perch was introduced into Lake Victoria in order to increase local fisheries. The Nile Perch is a predator and it started to eat most of the other fish.

While the Nile Perch became the primary export of the countries around the lake -- namely Uganda, Kenya and Tanzania -- depleted supplies over the last ten years of the smaller fish around the shores of the lake on which local fishermen subsisted meant that the local population was deprived of their main source of protein.

Furthermore, fishing the larger Nile Perch was unfeasible for local fishermen as the fish resided in the middle of Lake Victoria and larger fishing boats were required in order to fish them.

The solution: 'Boutique' fish farms

To combat this increasing problem, Prof. Berta Levavi-Sivan of the Hebrew University's Robert H. Smith Faculty of Agriculture, Food and Environment found a way to spawn several species of African carp and cultivate them in fish farms around Lake Victoria in Uganda. The project was initiated five years ago and has been financed by USAID-CDR (US Agency for International Development), in collaboration with Dr. Justus Rutaisire from Makerere University in Kampala, Uganda.

Last year, the developers of the project began establishing ponds in small villages around the shores of Lake Victoria, stocking them with fish from the fish farms -- thus enabling the local population to eat carp. The project has since developed and now, four large fish farms, whose owners were trained in

Israel, produce enough fingerlings to populate small ponds in villages around the lake. The people of each village, and especially their children, consume the project-fish as their main source of protein.

Prof. Levavi-Sivan hopes that soon, every village around the shores of Lake Victoria will have its own 'boutique' fish farm and that the project will be expanded to include other countries in Africa. "We succeeded in inducing spawning in the carp -- and these 14 villages are the success story of this project."

Helping her in this initiative is a group of students from Uganda, Kenya, Tanzania and Rwanda, who came to the University's Robert H. Smith Faculty of Agriculture, Food & Environment as part of a program organized by Mashav (Israel's Agency for International Development Cooperation) and the Hebrew University's Division of External Studies to study inland water aquaculture and help develop the existing project in Uganda.

A new challenge

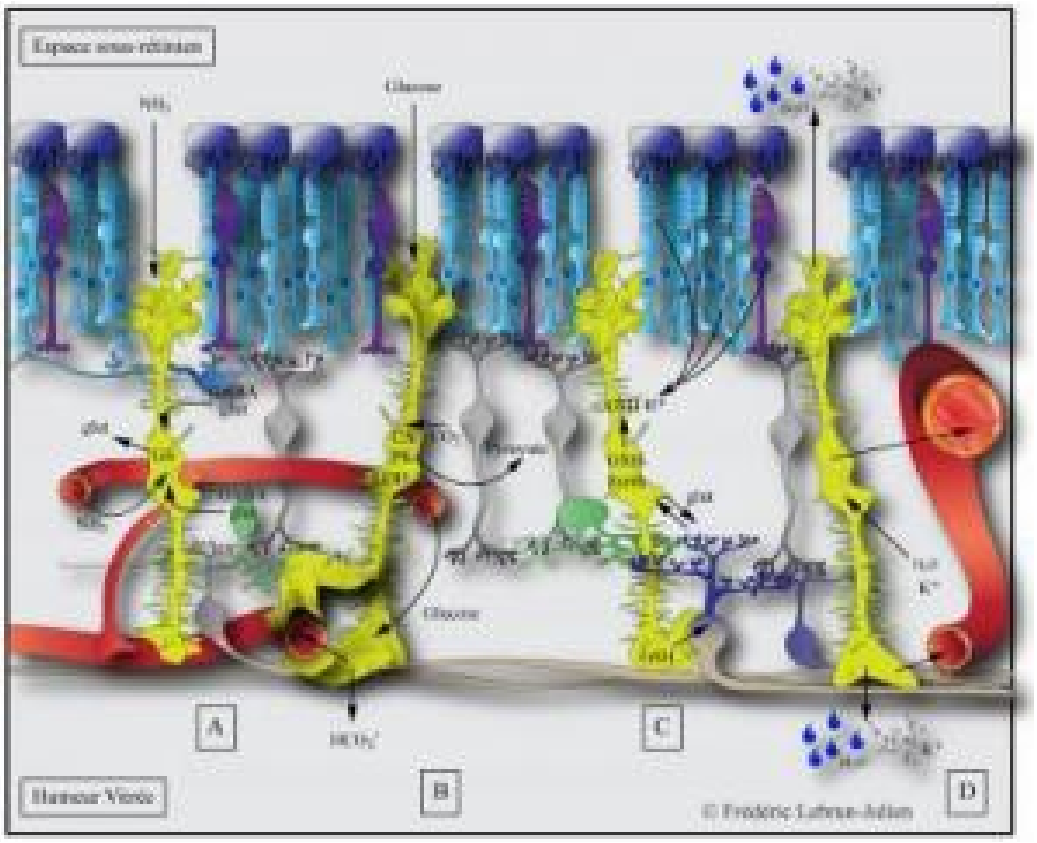
However, Prof. Levavi-Sivan and Dr. Justus Rutaisire are now facing another challenge. With the depletion of the smaller fish in the Lake, now the Nile Perch have nothing to eat and are themselves becoming depleted. Prof. Levavi-Sivan and Dr. Justus Rutaisire are therefore beginning a new project. Financed by the World Bank, they are working on finding ways to cultivate the Nile perch in aquaculture -- thus helping to boost Uganda's fish export industry, as well as the nutrition of the local population.

Story Source:

Adapted from materials provided by Hebrew University of Jerusalem.

http://www.sciencedaily.com/releases/2010/02/100208144629.htm

Double Agent: Glial Cells Can Protect or Kill Neurons, Vision



Glial cells normally protect neurons in the retina. (Credit: Frédéric Lebrun-Julien, Université de Montréal)

ScienceDaily (Feb. 8, 2010) — Scientists have identified a double agent in the eye that, once triggered, can morph from neuron protector to neuron killer. The discovery has significant health implications since the neurons killed through this process results in vision loss and blindness.

The findings, published in the journal *Proceedings of the National Academy of Sciences* (PNAS), are collaboration between the Université de Montreal, McGill University and the Montreal Neurological Institute in Canada and the Université de Namur in Belgium. The researchers show how an unusual molecule, called proNGF, activates glial cells that normally protect neurons in the retina and brain.

"We found that glial cells attack and kill neurons after being triggered by proNGF," says coauthor Dr. Philip Barker, a neuroscientist at the Montreal Neurological Institute and a professor at the McGill Department of Neurology and Neurosurgery. "Since glial cells normally protect neurons, we were surprised to find that proNGF can convert glial cells into killers that cause neuron death in the retina."

Coauthor Dr. Adriana Di Polo, a professor at the Université de Montréal Department of Pathology and Cell Biology, compares the proNGF molecule to a cell hijacker. "Before this study, we didn't know what physiological role the proNGF molecule played in the eye," she says. "We now propose that, following brain damage or neurodegenerative diseases, proNGF alters the glial cell network to change its function. Rather than protecting neurons, proNGF makes the glial cells attack neurons."

Scientists must now pay more attention to the damage proNGF can trigger. "Once retinal neurons die, they are gone forever and the permanent loss of these cells causes blindness," warns Dr. Di Polo.

"The next step for researchers is to explore whether proNGF signals can be controlled," says Frédéric Lebrun-Julien, first author and a PhD student at the Université de Montréal's Department of Pathology and Cell Biology.

Dr. Barker concurs. "If we can block factors induced by proNGF, we can protect neurons that would normally be lost. We think these findings may eventually translate into clinical benefits in diseases such as glaucoma."

The study was supported by the Canadian Institutes of Health Research and the Fonds de Recherche en Santé du Québec.

The paper, "ProNGF induces TNFα-dependent death of retinal ganglion cells through a p75NTR non-cell-autonomous signaling pathway," published in the journal PNAS, was authored by Frédéric Lebrun-Julien and Adriana Di Polo of the Université de Montréal; Olivier De Backer of the Université de Namur in Belgium; David Stellwagen, Mathieu J. Bertrand, Carlos R. Morales and Philip A. Barker of the Montreal Neurological Institute / McGill University.

Story Source:

Adapted from materials provided by University of Montreal.

http://www.sciencedaily.com/releases/2010/02/100201171647.htm

Better Sign of Blood Vessel Narrowing and Early Coronary Artery Disease

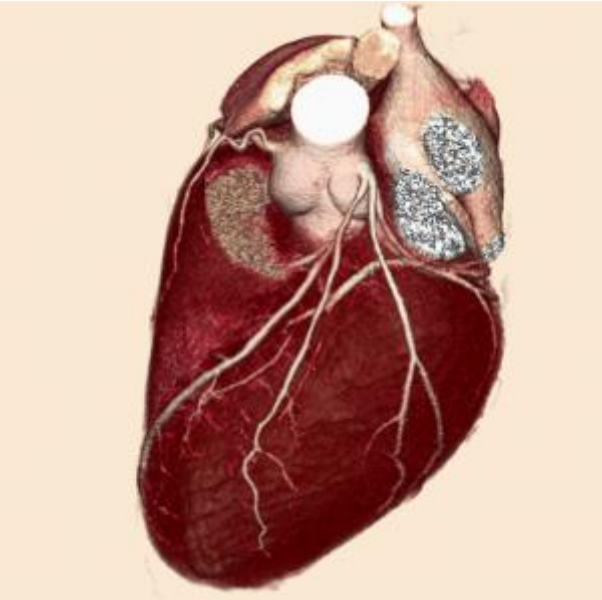


Image from a 320-CT scan of heart. (Credit: Image courtesy of Johns Hopkins Medical Institutions)

ScienceDaily (Feb. 8, 2010) — Cardiologists and heart imaging specialists at 15 medical centers in eight countries, and led by researchers at Johns Hopkins, have enrolled the first dozen patients in a year-long investigation to learn whether the subtle squeezing of blood flow through the inner layers of the heart is better than traditional SPECT nuclear imaging tests and other diagnostic radiology procedures for accurately tracking the earliest signs of coronary artery clogs.

Each year, nearly 800,000 American men and women with coronary artery disease suffer a heart attack, resulting in more than 150,000 deaths.

The latest international study of so-called CT perfusion imaging will involve the participation of some 400 men and women identified as being at higher risk of coronary artery disease because they have had symptoms of the illness, such as shortness of breath, chest pain or fatigue. All qualify for a more detailed inspection of their heart's blood vessels by cardiac catheterization, an invasive procedure in which a thin plastic tube is directly inserted into the heart's blood vessels to detect blockages and help widen each artery as needed.

"Our study goal is to out how well various imaging tests measure the degree of blockage or narrowing in any particular artery and therefore which is more useful in predicting patients who need catheterization or angioplasty, or bypass surgery," says cardiologist and senior study investigator João Lima, M.D. "Some patients would do just as well or better with drug therapy to maintain a healthy blood flow to the heart, but we need to better sort out who they are with more accuracy."

Lima says that as many as one-fifth of the 1.3 million cardiac catheterizations performed each year nationwide show no blockages.

In addition to having a standard SPECT imaging test, in which radioactive chemicals are injected into the body to produce 3-D images of the blood vessels, all study participants will undergo before catheterization another test to map out the blood vessels and any potential blockages, a CT angiogram (CTA), plus a CT perfusion (CTP) imaging test to gauge any changes in the volume of blood flow.

Key to performing both CTA and CTP is use of the 320 computed tomography scanner, the most advanced technology available to image the heart and its surrounding blood vessels. The device was first installed in North America at Johns Hopkins in 2007 and can produce three-D images of blood vessels no bigger than the average width of a toothpick (1.5 millimeters). Results from both 320-CT tests will be compared to those from SPECT and what is found by cardiac catheterization.

"Perfusion imaging is a simple and easy test for patients to undergo," says Lima, who adds that the whole procedure usually takes less than 20 minutes to set up and perform. Cardiac catheterization, which also checks for heart vessel blockages, takes longer, between 30 minutes and 45 minutes to perform, and requires several hours for recovery. Potential complications from the invasive procedure, although rare, include heart attack, stroke and death.

"If we can more easily examine patients, then we can reduce the amount of time needed in hospital and, we hope, reduce the number of invasive procedures, which are more inconvenient and open to greater risk to patients from complications," says Lima, a professor of medicine and radiology at the Johns Hopkins University School of Medicine and its Heart and Vascular Institute.

More than a quarter-million Americans undergo coronary bypass surgery each year, and another 1.2 million people undergo angioplasty, a procedure much like catheterization that forcibly opens narrowed arteries.

Lead study investigator and cardiologist Richard George, M.D., part of the Johns Hopkins team that developed special computer software to accurately measure the speed of blood flowing through the heart's arteries and muscle, says the 320-CT is fast and exposes patients to far less radiation.

George, an assistant professor at Hopkins where he also serves as director of its CT Perfusion Laboratory, says a CTP takes three seconds or less of actual scanning and, if done correctly, involves an average radiation exposure of about 8 millisieverts. A SPECT test, he says, averages between 10 millisieverts and 26 millisieverts, and cardiac catheterization ranges between 2 millisieverts and 10 millisieverts. The 320-CT scanning device has at least five times the speed and power of the 64-CT scanners in widespread use elsewhere.

The scanner's software compares ratios of brightly dyed blood flows between the innermost and outermost layers of heart muscle, where the effects of arterial narrowing first appear.

As part of CTP imaging, each patient is injected with a chemical dye containing iodine, known to light up on screen when struck by the scanner's X-rays. Lower concentrations of iodine will show up as darker regions, indicating constrained and reduced blood flow, the underlying cause of chest pain, than brighter regions where blood flow is more uniform and free flowing.

To enhance the image, blood flow to the heart is sped up through chemical injections of adenosine, which causes the blood-pumping organ to beat faster.

Previous research by the team among 60 patients with suspected coronary artery disease showed that using dual testing with CTA and CTP had almost the same statistical predictive values as SPECT, prompting the team's latest investigation to see if the dual tests were as clinically useful as SPECT.

George cautions that CT scans are not a substitute for catheterization, but are "an alternative diagnostic tool" physicians can use to "get a real picture" of the extent of coronary blockages and their effects on blood flow, especially when physicians need both sets of information to make treatment decisions.

The CT device being used in the study is an Aquilion One, a 320 detector row CT scanner manufactured by Toshiba.

Toshiba also provided funding support for the study, called CORE-320, short for Coronary Artery Evaluation Using 320-row Multidetector Computed Tomography.

The CORE-320 study follows another imaging study, called CORE-64, which showed that 64-CT was almost as good as cardiac catheterizations in predicting which patients with suspected coronary disease actually had coronary blockages.

In addition to Lima and George, other Hopkins researchers involved in this study are Armin Arbab-Zadeh, M.D.; Julie Miller, M.D.; Jeffrey Brinker, M.D.; David Bluemke, M.D.; Andrea Vavere, M.S.; John Texter, P.A.; Albert Lardo, Ph.D.; Eric Bukata; and Christopher Cox, Ph.D.

Other CORE-320 participating sites include in the United States, Beth Israel Deaconess Medical Center and the Brigham and Women's Hospital, both in Boston, plus the U.S. National Heart, Lung and Blood Institute, a member of the National Institutes of Health, in Bethesda, Md.; in Canada, Toronto General Hospital, part of the University Health Network; in Denmark, the Rigshospitalet at the University of Copenhagen; in Germany, Charité Universitätsmedizin in Berlin; in the Netherlands, Leiden University Medical Center; in Brazil, the Heart Institute of the Clinical Hospital of Sao Paulo University's Medical College in Botucatu, and the Hospital Israelita Albert Einstein in Sao Paulo; in Singapore, Medi-Rad Associates Radiologic Clinic at Mount Elizabeth Medical Centre, and the National Heart Centre Singapore; and in Japan, Iwate Medical University in Morioka, Mie University School of Medicine in Tsu City, and Keio University's School of Medicine in Tokyo.

Story Source:

Adapted from materials provided by Johns Hopkins Medical Institutions.

http://www.sciencedaily.com/releases/2010/02/100203172851.htm

The Stars Behind the Curtain

NGC 3603 is a starburst region: a cosmic factory where stars form frantically from the nebula's extended clouds of gas and dust. Located 22 000 light-years away from the Sun, it is the closest region of this kind known in our galaxy, providing astronomers with a local test bed for studying the intense star formation processes, very common in other galaxies, but hard to observe in detail because of their large distance. The newly released image, obtained with the FORS instrument attached to one of the four 8.2-metre VLT Unit Telescopes at Cerro Paranal, Chile, is a three-colour combination of exposures acquired through visible and near-infrared (V, R, I) filters. This image portrays a wider field around the stellar cluster and reveals the rich texture of the surrounding clouds of gas and dust. The field of view is 7 arcminutes wide. (Credit: ESO)

ScienceDaily (Feb. 8, 2010) — ESO is releasing a magnificent VLT image of the giant stellar nursery surrounding NGC 3603, in which stars are continuously being born. Embedded in this scenic nebula is one of the most luminous and most compact clusters of young, massive stars in our Milky Way, which therefore serves as an excellent "local" analogue of very active star-forming regions in other galaxies. The cluster also hosts the most massive star to be "weighed" so far.

NGC 3603 is a starburst region: a cosmic factory where stars form frantically from the nebula's extended clouds of gas and dust. Located 22 000 light-years away from the Sun, it is the closest region of this kind known in our galaxy, providing astronomers with a local test bed for studying intense star formation processes, very common in other galaxies, but hard to observe in detail because of their great distance from us.

The nebula owes its shape to the intense light and winds coming from the young, massive stars which lift the curtains of gas and clouds revealing a multitude of glowing suns. The central cluster of stars inside NGC 3603 harbours thousands of stars of all sorts: the majority have masses similar to or less than that of our Sun, but most spectacular are several of the very massive stars that are close to the end of their lives.

Several blue supergiant stars crowd into a volume of less than a cubic light-year, along with three so-called Wolf-Rayet stars -- extremely bright and massive stars that are ejecting vast amounts of material before finishing off in glorious explosions known as supernovae. Using another recent set of observations performed with the SINFONI instrument on ESO's Very Large Telescope (VLT), astronomers have confirmed that one of these stars is about 120 times more massive than our Sun, standing out as the most massive star known so far in the Milky Way [1].

The clouds of NGC 3603 provide us with a family picture of stars in different stages of their life, with gaseous structures that are still growing into stars, newborn stars, adult stars and stars nearing the end of their life. All these stars have roughly the same age, a million years, a blink of an eye compared to our five billion year-old Sun and Solar System. The fact that some of the stars have just started their lives while others are already dying is due to their extraordinary range of masses: high-mass stars, being very bright and hot, burn through their existence much faster than their less massive, fainter and cooler counterparts.

The newly released image, obtained with the FORS instrument attached to the VLT at Cerro Paranal, Chile, portrays a wide field around the stellar cluster and reveals the rich texture of the surrounding clouds of gas and dust.

Note:

[1] The star, NGC 3603-A1, is an eclipsing system of two stars orbiting around each other in 3.77 days. The most massive star has an estimated mass of 116 solar masses, while its companion has a mass of 89 solar masses.

Story Source:

Adapted from materials provided by European Southern Observatory - ESO.

http://www.sciencedaily.com/releases/2010/02/100203084300.htm

Agricultural Scientists Turn to a Wild Oat to Combat Crown Rust

Plant pathologist Martin Carson (left) and technician Jerry Ochocki inspect crown rust infections on common buckthorn, an alternate host. Multiple varieties of oats are planted between rows of infected buckthorn to determine which varieties can resist crown rust. (Credit: Photo by Stephen Ausmus)

ScienceDaily (Feb. 8, 2010) — Agricultural Research Service (ARS) scientists are tapping into the DNA of a wild oat, considered by some to be a noxious weed, to see if it can help combat crown rust, the most damaging fungal disease of oats worldwide.

Crown rust reduces oat yields up to 40 percent and shows a remarkable ability to adapt to varieties bred to genetically resist it. ARS researchers and colleagues have inserted individual resistance genes into oat varieties that produce proteins believed to recognize strains of crown rust and trigger a defense response against them. "Multiline" cultivars with several resistance genes also have been developed.

Crown rust is caused by *Puccinia coronata,* a fungus that reproduces both sexually and asexually and has enough genetic flexibility to overcome resistance genes, usually in about five years, according to Martin L. Carson, research leader at the ARS Cereal Disease Laboratory in St. Paul, Minn. His analysis also shows crown rust is increasing in virulence throughout North America.

Carson has turned to awild variety, *Avena barbata,* for new genes with effective resistance. The slender oat, listed as a noxious weed in Missouri and classified as moderately invasive in California, grows wild in South Asia, much of Europe and around the Mediterranean region.

Carson inoculated *A. barbata* seedlings with crown rust. After several crosses, he found seedlings highly resistant to a variety of crown rust strains. In ongoing studies, he is crossing them with the domestic oat, *A. sativa,* to try to develop the right blend of resistance and desirable traits, such as high yield and drought tolerance. The goal is new plant lines that will effectively fight off crown rust for many years.

The research, which supports the U.S. Department of Agriculture (USDA) priority of promoting international food security, was published in the journal *Plant Disease*.

Story Source:

Adapted from materials provided by USDA/Agricultural Research Service. Original article written by Dennis O'Brien.

http://www.sciencedaily.com/releases/2010/02/100204144545.htm

'Starving' Fat Suppresses Appetite

Randy Seeley, PhD (Credit: Image courtesy of University of Cincinnati Academic Health Center)

ScienceDaily (Feb. 8, 2010) — Peptides that target blood vessels in fat and cause them to go into programmed cell death (termed apoptosis) could become a model for future weight-loss therapies, say University of Cincinnati (UC) researchers.

A research team led by Randy Seeley, PhD, of UC's Metabolic Diseases Institute, has found that obese animal models treated with proapoptotic peptide experienced decreased food intake and significant fat loss.

The study was published online ahead of print Jan. 26, 2010, in *Diabetes*, the official journal of the American Diabetes Association.

White adipose (fat) tissue is vascularized, much like a tumor, and growth of fat tissue is highly dependent on the tissue's ability to build new blood vessels -- a phenomenon called angiogenesis.

Inhibiting adipose angiogenesis -- essentially "starving" fat tissue -- can reverse the effects of a high-fat diet in mice and rats, says Seeley.

"The body is extremely efficient at controlling energy balance," says Seeley, a professor in UC's internal medicine department and recipient of the 2009 Outstanding Scientific Achievement Award from the American Diabetes Association.

"Think of fat tissue like a bathtub," he says. "To keep the amount of water the same, you have to make sure that the speed of the water coming in and the water going out match. If the water is coming in faster than the water is going out, eventually you have to build a bigger bathtub.

"Obesity is the same. People who eat more calories than they burn have to build a bigger fat tissue 'bathtub,' and building new blood vessels is crucial to building this bigger bathtub. For each additional pound of fat tissue, you need to build a mile of blood vessels.

"What we found is that if we can target these fat tissue blood vessels, animals eat less and lose weight as their 'bathtubs' get smaller."

Seeley and his team treated lean and obese mice and rats with the proapoptotic peptide for periods of four or 27 days. They measured energy intake and expenditure daily in all animals -- some on low-fat diets, others on high-fat diets. The team found that the peptide completely reversed high-fat-diet-induced obesity in already obese mice and also reduced body weight in the mice and rats placed on high-fat diets. No changes were recorded in animals on low-fat diets.

Seeley's team found that fat loss was occurring without major changes to energy expenditure, but with reduced food intake. The authors noted that there were no signs of illness with this treatment and results were independent of the actions of the appetite-controlling hormone leptin.

"These experiments indicate that there is a novel system that informs our brains about the size of our fat tissue 'bathtubs' and can influence how much we eat," says Seeley. "The findings highlight the ability to provide new therapeutic strategies for obesity based on these dynamics of blood vessels in our fat tissue." The next step, Seeley says, is to out the important signals that come from fat that cause the weight loss.

This study was supported by grants from the National Institute of Diabetes and Digestive and Kidney Diseases. Co-authors include Dong-Hoon Kim, PhD, and Stephen Woods, PhD, both of the University of Cincinnati.

Story Source:

Adapted from materials provided by University of Cincinnati Academic Health Center.

http://www.sciencedaily.com/releases/2010/02/100201113756.htm

Scientists Identify First Genetic Variant Linked to Biological Aging in Humans

Scientists announced they have identified for the first time definitive variants associated with biological ageing in humans. (Credit: iStockphoto/Anne De Haas)

ScienceDaily (Feb. 8, 2010) — Scientists announced they have identified for the first time definitive variants associated with biological ageing in humans. The team analyzed more than 500,000 genetic variations across the entire human genome to identify the variants which are located near a gene called TERC.

The study in *Nature Genetics* published by researchers from the University of Leicester and King's College London, working with University of Groningen in the Netherlands, was funded by The Wellcome Trust and the British Heart Foundation.

British Heart Foundation Professor of Cardiology at the University of Leicester Professor Nilesh Samani, of the Department of Cardiovascular Sciences, who co-led the project explained that there are two forms of ageing -- chronological ageing i.e. how old you are in years and biological ageing whereby the cells of some individuals are older (or younger) than suggested by their actual age.

He said: "There is accumulating evidence that the risk of age-associated diseases including heart disease and some types of cancers are more closely related to biological rather than chronological age.

"What we studied are structures called telomeres which are parts of one's chromosomes. Individuals are born with telomeres of certain length and in many cells telomeres shorten as the cells divide and age. Telomere length is therefore considered a marker of biological ageing.

"In this study what we found was that those individuals carrying a particular genetic variant had shorter telomeres i.e. looked biologically older. Given the association of shorter telomeres with age-associated diseases, the finding raises the question whether individuals carrying the variant are at greater risk of developing such diseases"

Professor Tim Spector from King's College London and director of the TwinsUK study, who co-led this project, added:

"The variants identified lies near a gene called TERC which is already known to play an important role in maintaining telomere length. What our study suggests is that some people are genetically programmed to age at a faster rate. The effect was quite considerable in those with the variant, equivalent to between 3-4 years of 'biological aging" as measured by telomere length loss. Alternatively genetically susceptible people may age even faster when exposed to proven 'bad' environments for telomeres like smoking, obesity or lack of exercise -- and end up several years biologically older or succumbing to more age-related diseases. "

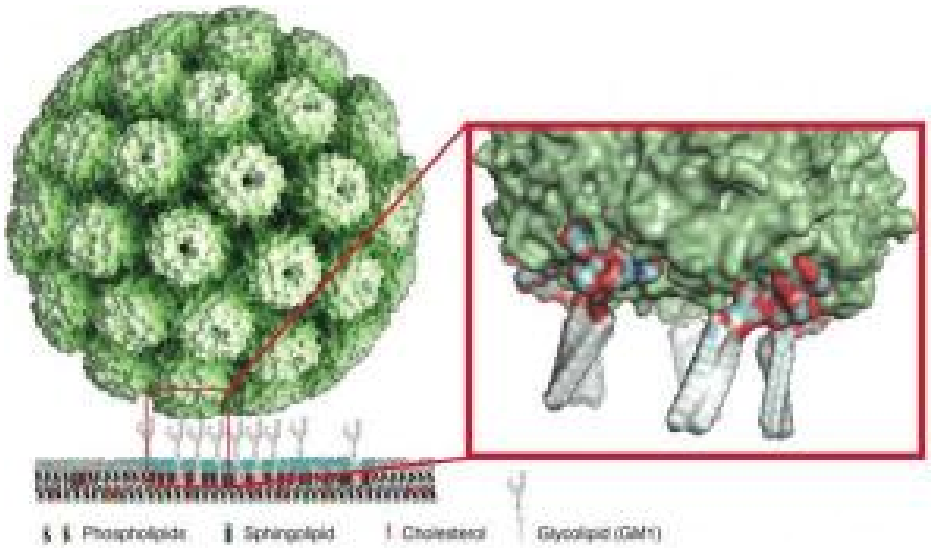
The paper, will be published online in *Nature Genetics* on 07 February 2010.

Story Source:

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

http://www.sciencedaily.com/releases/2010/02/100207145351.htm

Some Viruses Use Fats to Penetrate a Cell



The icosahedric SV40 binds to glycolipids, a class of cell membrane fats. (Figure not to scale) (Credit: Image courtesy of ETH Zurich)

ScienceDaily (Feb. 8, 2010) — SV40 viruses use an amazing means of communication, in order to be able to penetrate into a cell: fats, whose structure must fit like a key in a lock.

Just like a ball, driven into the goal, causing the net to bulge out and wrap itself closely around the leather: This is how it appears when the Simian Virus 40 (SV40) penetrates into a cell. The virus docks onto the cell membrane, which in turn invaginates deeply, wraps itself tightly around the intruder and buds into a vesicle that is finally pinched off inside the cell.

Suitable Trojans required

Until recently, scientists were unable to explain how this dramatic rearrangement of the cell membrane took place in order to make it possible for the virus to penetrate, since only few proteins seem to be involved in this process. A new work, which has just appeared in Nature Cell Biology, now throws new light on the mechanism by which the SV40 outwits its host: it exploits the components of the cell membrane itself, fats.

If a virus wants to reproduce itself, the same question generally arises: How does it get into a cell in order to use the latter's reproductive mechanism for its own purposes? After all, although viruses carry with them a short piece of genetic information depending upon their type, they need to penetrate into the cell and its nucleus in order to propagate their genome. There, the cells own replication machinery is reprogrammed to produce new viruses, which finally abandon the cell and infect further cells.

Fats as a Velcro fastener

SV40 has now developed a unique strategy. Instead of binding to a protein receptor in the plasma membrane and entering vesicles created by an apparatus around the protein molecule clathrin, this polyomavirus attaches itself to lipids. It does however not bind to one receptor, but many lipid molecules, in a similar way to a Velcro fastener. The individual connections are weak, but many connections taken together are strong. As soon as the virus has connected itself to many fats, the plasma membrane of the cell changes dramatically: It undergoes deep invagination and, in the course of time, completely surrounds the virus and finally forms a vesicle, which is pinched off inside the cell.

Interestingly the many connections are not only important for virus binding, but also for this membrane deformation process. The researchers could show that different molecules binding to the same fat cannot deform the membranes. At least five fat connections were required for membrane deformation. The membrane is then organized so closely around the virus that hardly any space remains between its surface and the virus. The virus in this way optimizes the number of connections with the membrane and can exert a strong force on the membrane sufficient to deform it without the help of cellular proteins.

Short chains do not bind

In addition, the correct fats must be present on the surface of the virus. The carbon chains forming part of the fat must be of the correct length. If they are too short, then the membrane does not invaginate. This has been demonstrated by experiments with structurally altered fats.

"It surprised us that there is a relationship between structure and function even with fats," observed Helge Ewers, ETH Group-Leader, who signs as primary author of the paper. With proteins, such key/lock principles are common. "With this work we have proven that it can also be the same for fats," says the former graduate student of Ari Helenius, Professor of Biochemistry.

Widely distributed mechanism

In co-operation with the Curie Institute in France the ETH researchers were able to show that SV40 is not the only pathogen, which gains entry to cells via multi-lipid connections. This route is also taken by bacterial toxins, such as, for instance, the cholera toxin or mouse polyomavirus. It thus seems to be a widespread mechanism.

It is not yet possible, however, to use this knowledge therapeutically. Antiviral medicines continue to eliminate the infected cells. Finding active substances, which block the viral fat connection, is considered by Ewers and Helenius to be a difficult task.

SV40

SV40 naturally infects Asian apes, such as macaques and rhesus monkeys. It can also be passed on to humans. In the '60s it was discovered in cultures of kidney cells from rhesus monkeys. The cells were used for the production of vaccines against polio, the childhood paralysis. During the inoculation from 1955 to 1963 several million humans were probably infected with SV40. Like other polyomaviruses, SV40 can cause tumours under certain conditions. However, in most cases the infection remains symptom-free. In humans no direct connections between an SV40-infection and the emergence of cancer could be proven. Oncogenes of this virus, however, play a role in the emergence of cancer cells from human cells in cell culture.

Story Source:

Adapted from materials provided by ETH Zurich.

Journal Reference:

1. Ewers H et al. **GM1 structure determines SV40-induced diaphragm invagination and infection**. *Nature Cell Biology*, 20 December 2009 DOI: 10.1038/ncb1999

http://www.sciencedaily.com/releases/2010/01/100129105934.htm

Carbonate Veins Reveal Chemistry of Ancient Seawater

Calcium carbonate veins are common in upper ocean crust, where they precipitate from low temperature ((Credit: Christopher Smith-Duque (NOCS))

ScienceDaily (Feb. 8, 2010) — The chemical composition of our oceans is not constant but has varied significantly over geological time. In a study published in *Science*, researchers describe a novel method for reconstructing past ocean chemistry using calcium carbonate veins that precipitate from seawater-derived fluids in rocks beneath the seafloor.

The research was led by scientists from the University of Southampton's School of Ocean and Earth Science (SOES) hosted at the National Oceanography Centre, Southampton (NOCS).

"Records of ancient seawater chemistry allow us to unravel past changes in climate, plate tectonics and evolution of life in the oceans. These processes affect ocean chemistry and have shaped our planet over millions of years," said Dr Rosalind Coggon, formerly of NOCS now at Imperial College London.

"Reconstructing past ocean chemistry remains a major challenge for Earth scientists, but small calcium carbonate veins formed from warm seawater when it reacts with basalts from the oceanic crust provide a unique opportunity to develop such records," added co-author Professor Damon Teagle from SOES.

Calcium carbonate veins record the chemical evolution of seawater as it flows through the ocean crust and reacts with the rock. The composition of past seawater can therefore be determined from suites of calcium carbonate veins that precipitated millions of years ago in ancient ocean crust.

The researchers reconstructed records of the ratios of strontium to calcium (Sr/Ca) and magnesium to calcium (Mg/Ca) over the last 170 million years. To do this, they analysed calcium carbonate veins from basaltic rocks recovered by several decades of scientific deep-ocean drilling by the Integrated Ocean Drilling Program (IODP) and its predecessors.

"The carbonate veins indicate that both the Sr/Ca and Mg/Ca ratios of seawater were significantly lower than at present prior to about 25 million years ago. We attribute the increases in seawater Sr/Ca and

Mg/Ca since then to the long-term effects of decreased seafloor volcanism and the consequent reduction in chemical exchange between seawater and the ocean crust," said Professor Teagle.

The research was supported by the United Kingdom's Natural Environment Research Council and used samples provided by the Ocean Drilling Program (ODP) and Integrated Ocean Drilling Program (IODP). ODP was sponsored by the US National Science Foundation (NSF) and participating countries under management of Joint Oceanographic Institutions Inc. IODP is supported by NSF; Japan's MEXT; ECORD; and the People's Republic of China, Ministry of Science and Technology.

The researchers are Rosalind M. Coggon (Imperial College London), Damon A.H. Teagle, Christopher E. Smith-Duque, and Matthew J. Cooper (SOES, University of Southampton) and Jeffrey C. Alt (University of Michigan).

Story Source:

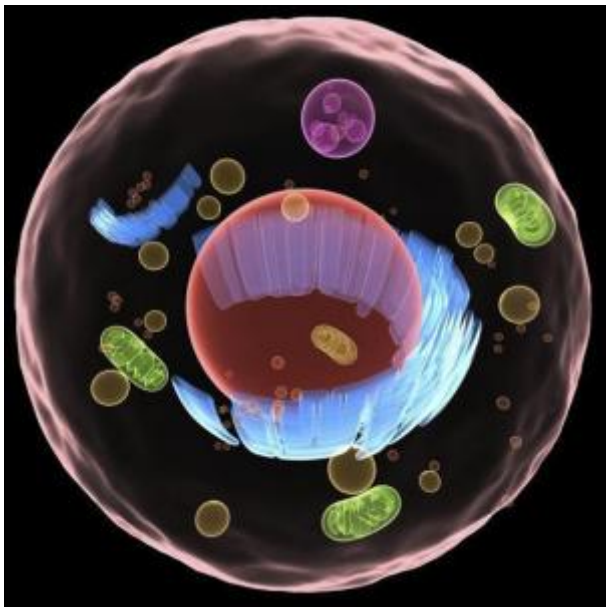
Adapted from materials provided by National Oceanography Centre, Southampton (UK).

Journal Reference:

1. Coggon, R. M., Teagle, D. A. H., Smith-Duque, C. E., Alt, J. C., & Cooper, M. J. **Reconstructing Past Seawater Mg/Ca and Sr/Ca from Mid-Ocean Ridge Flank Calcium Carbonate Veins**. *Science*, 2010; DOI: 10.1126/science.1182252

http://www.sciencedaily.com/releases/2010/02/100205091823.htm

Did Bacteria Develop Into More Complex Cells Much Earlier in Evolution Than Thought?



Artist's rendering of cell structure. New research explains how mitochondria -- the power house of human and other cells, which provide complex eukaryotic cells with energy and ability to produce, divide and move -- were thought to have evolved about 2000 million years ago from primitive bacteria. (Credit: iStockphoto/Sebastian Kaulitzki)

ScienceDaily (Feb. 8, 2010) — Monash University biochemists have found a critical piece in the evolutionary puzzle that explains how life on Earth evolved millions of centuries ago.

The team, from the School of Biomedical Sciences, has described the process by which bacteria developed into more complex cells and found this crucial step happened much earlier in the evolutionary timeline than previously thought.

Team leader and ARC Federation Fellow Trevor Lithgow said the research explained how mitochondria -- the power house of human and other cells, which provide complex eukaryotic cells with energy and ability to produce, divide and move -- were thought to have evolved about 2000 million years ago from primitive bacteria.

"We have now come to understand the processes that drove cell evolution. For some time now the crux of this problem has been to understand how eukaryotes first came to be. The critical step was to transform small bacteria, passengers that rode within the earliest ancestors of these cells, into mitochondria, thereby beginning the evolution of more complex life-forms," Professor Lithgow said.

The team found that the cellular machinery needed to create mitochondria was constructed from parts pre-existing in the bacterium. These parts did other jobs for the bacterium, and were cobbled together by evolution to do something new and more exciting.

"Our research has crystallised with work from other researchers around the world to show how this transformation happened very early on -- that the eukaryotes were spawned by integrating the bacterium as a part of themselves. This process jump-started the evolution of complex life much more rapidly than was previously thought."

The research consisted of two components, the first used computers to read, compare and understand DNA sequences. From this, experiments were designed to do actual laboratory testing using a bacterium that is the closest living relative to the original ancestor of the mitochondria.

The research was published in the journal *Science*.

Professor Lithgow said the latest findings were only made possible due to a gradual gathering of evidence within the scientific community and recent developments in genome sequencing. "We can now "read" with great care and insight genome sequences -- the complete DNA sequence of any organism. From these sequences we find tell-tale clues to the past. Our findings are relevant to all species, including the evolution of humans," Professor Lithgow said.

"It continues to amaze that this theory, proposed in the century before the advent of molecular investigations, is so accurate on a molecular scale. This improved understanding is directly relevant to the big picture timeline for the evolution of life."

Professor Lithgow said the findings will be regarded by some scientists as controversial as many have long-held views on the process of evolution as a tinkerer. "This will surprise and may even spark debate. However our research compliments the basic rules of life. Even at the molecular level, the rules of the game are the same. Evolution drives biology to more and more complex forms," Professor Lithgow said.

Story Source:

Adapted from materials provided by Monash University.

Journal Reference:

1. Felicity Alcock, Abigail Clements, Chaille Webb, and Trevor Lithgow. **Tinkering Inside the Organelle**. *Science*, 2010; 327 (5966): 649-650 DOI: 10.1126/science.1182129

http://www.sciencedaily.com/releases/2010/02/100205091829.htm

Bioactive Nanomaterial Promotes Growth of New Cartilage

3D illustration of the knee. Damaged cartilage can lead to joint pain and loss of physical function and eventually to osteoarthritis. (Credit: iStockphoto/Sebastian Kaulitzki)

ScienceDaily (Feb. 8, 2010) — Northwestern University researchers are the first to design a bioactive nanomaterial that promotes the growth of new cartilage in vivo and without the use of expensive growth factors. Minimally invasive, the therapy activates the bone marrow stem cells and produces natural cartilage. No conventional therapy can do this.

The results will be published online the week of Feb. 1 by the *Proceedings of the National Academy of Sciences* (PNAS).

"Unlike bone, cartilage does not grow back, and therefore clinical strategies to regenerate this tissue are of great interest," said Samuel I. Stupp, senior author, Board of Trustees Professor of Chemistry, Materials Science and Engineering, and Medicine, and director of the Institute for BioNanotechnology in Medicine. Countless people -- amateur athletes, professional athletes and people whose joints have just worn out -- learn this all too well when they bring their bad knees, shoulders and elbows to an orthopaedic surgeon.

Damaged cartilage can lead to joint pain and loss of physical function and eventually to osteoarthritis, a disorder with an estimated economic impact approaching $65 billion in the United States. With an aging and increasingly active population, this is expected to grow.

"Cartilage does not regenerate in adults. Once you are fully grown you have all the cartilage you'll ever have," said first author Ramille N. Shah, assistant professor of materials science and engineering at the McCormick School of Engineering and Applied Science and assistant professor of orthopaedic surgery at the Feinberg School of Medicine. Shah is also a resident faculty member at the Institute for BioNanotechnology in Medicine.

Type II collagen is the major protein in articular cartilage, the smooth, white connective tissue that covers the ends of bones where they come together to form joints.

"Our material of nanoscopic fibers stimulates stem cells present in bone marrow to produce cartilage containing type II collagen and repair the damaged joint," Shah said. "A procedure called microfracture is the most common technique currently used by doctors, but it tends to produce a cartilage having predominantly type I collagen which is more like scar tissue."

The Northwestern gel is injected as a liquid to the area of the damaged joint, where it then self-assembles and forms a solid. This extracellular matrix, which mimics what cells usually see, binds by molecular design one of the most important growth factors for the repair and regeneration of cartilage. By keeping the growth factor concentrated and localized, the cartilage cells have the opportunity to regenerate.

Together with Nirav A. Shah, a sports medicine orthopaedic surgeon and former orthopaedic resident at Northwestern, the researchers implanted their nanofiber gel in an animal model with cartilage defects.

The animals were treated with microfracture, where tiny holes are made in the bone beneath the damaged cartilage to create a new blood supply to stimulate the growth of new cartilage. The researchers tested various combinations: microfracture alone; microfracture and the nanofiber gel with growth factor added; and microfracture and the nanofiber gel without growth factor added.

They found their technique produced much better results than the microfracture procedure alone and, more importantly, found that addition of the expensive growth factor was not required to get the best results. Instead, because of the molecular design of the gel material, growth factor already present in the body is enough to regenerate cartilage.

The matrix only needed to be present for a month to produce cartilage growth. The matrix, based on self-assembling molecules known as peptide amphiphiles, biodegrades into nutrients and is replaced by natural cartilage.

The National Institutes of Health and the company Nanotope supported the research.

Story Source:

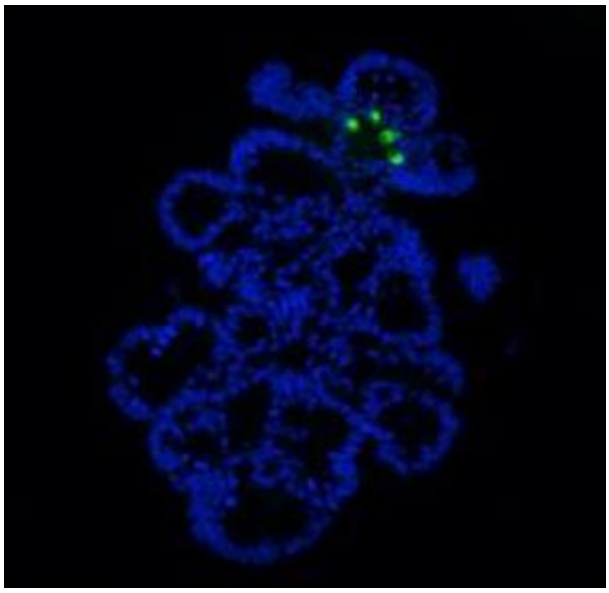
Adapted from materials provided by Northwestern University.

Journal Reference:

1. Samuel Stupp, Ramille Shah, Nirav Shah, Marc M. Del Rosario Lim, Caleb Hsieh and Gordon Nuber. **Supramolecular Design of Self-assembling Nanofibers for Cartilage Regeneration**. *Proceedings of the National Academy of Sciences*, Feb 1, 2010

http://www.sciencedaily.com/releases/2010/02/100201171649.htm

Targeting Cancer Stem Cells in the Lab



A colony of various cell types found in the gut grown in the lab from a single bowel cancer stem cell. (Credit: Image courtesy of University of Oxford)

ScienceDaily (Feb. 8, 2010) — Understanding of the particular cancer cells within a tumour that drive its growth could now advance more rapidly, thanks to Oxford University scientists. They show in the journal *PNAS* how a crucial class of cancer cell, called cancer stem cells, can be investigated in the lab in ways that should greatly speed their study, and allow the development of drugs targeted against them.

'Cancer stem cells drive the growth of a tumour,' says Dr Trevor Yeung of the Weatherall Institute of Molecular Medicine at Oxford University. 'If we could target treatments against these cells specifically, we should be able to eradicate the cancer completely.'

He adds: 'Radiotherapy and chemotherapy work against all rapidly dividing cells. But there is increasing evidence that cancer stem cells are more resistant than other cells to this treatment. Cancer stem cells that have not been eradicated can lead to later recurrence of cancer.'

'It's like trying to weed the garden. It's no good just chopping off the leaves, we need to target the roots to stop the weeds coming back.'

Cancer cells in tumours are not all exactly the same. Tumours are now understood to contain different types of cells, and it is the cancer stem cells that retain the ability to drive the tumour's growth.

They are called cancer stem cells because, like stem cells present in normal tissues of the body, they can produce further cells like themselves and also differentiate to provide various different cell types.

'But a better, more descriptive name would be cancer-driving cells or tumour-initiating cells,' says Dr Yeung, a Cancer Research UK scientist and first author on the paper.

Study of these cancer-driving cells within tumours has been slow because it has been hard to identify them unequivocally, separate them out and study them in the lab.

Previously, identifying cancer stem cells has relied on working with cancer biopsies from human patients. Scientists have tried to enrich the number of cancer stem cells present in samples and then see if those

cells are sufficient to initiate tumours in mice. This is a long process, and the samples can't then be used in further experiments.

The Cancer Research UK-funded scientists in Oxford have developed a new way of obtaining samples rich in cancer stem cells from bowel cancer cell lines and maintaining them in simple cell cultures in the lab.

The work involved the use of established cell lines, known biological markers to isolate the cancer stem cells, and largely standard cell culture conditions. These are the tools necessary to change the way research on cancer stem cells can be carried out. It should allow repeatable, high-throughput screens of drugs, as well as basic studies to characterise cancer stem cells and their roles in advancing tumours.

'Working with cell lines is a much more convenient way to study these cells than using samples taken from human patients or using animal models,' says Professor Sir Walter Bodmer, who led the work. 'We can now evaluate anti-cancer drugs better to see whether they attack cancer stem cells. If you don't attack these cells, the cancer can grow out again.'

'In the long term, it should allow the development of more useful, safe and specific drugs targeting cancer stem cells,' adds Dr Yeung.

The work also reveals that cancer stem cells are not necessarily just a small subset of cells within a tumour, as has been widely assumed. The researchers found that the proportion of cancer stem cells within different bowel cancers can vary widely, with higher proportions of cancer stem cells correlating with more aggressive tumours.

'People have assumed that cancer stem cells made up a small proportion of the cells in a tumour, but it is becoming increasingly clear that this is not correct. The most aggressive tumours can have a majority of cells that are cancer stem cells,' says Dr Yeung.

Story Source:

Adapted from materials provided by University of Oxford.

http://www.sciencedaily.com/releases/2010/01/100131145507.htm

Transplant first in kidney sister

A pioneering procedure has allowed a British woman to get a new kidney from her sister - even though the organ would normally be rejected.

Maxine Bath had been kept alive by dialysis, and had no matching donors in her family.

However, doctors in Coventry used a technique called "cryofiltration" to remove the immune molecules that cause rejection.

Doctors said it could allow more people to undergo transplants.

" **I'm already feeling healthier - I am looking forward to being able to eat food I couldn't have at all before, like nuts and chocolate** "
Maxine Bath

A total of 927 kidney transplants from "living donors" took place in Britain last year, although thousands more people remain on waiting lists, because a matching donor cannot be found.

Organ rejection happens when the body recognises the new organ as foreign, and the immune system reacts against it.

The risk can be reduced if the donor organ comes from another family member, and patients will often take drugs for the rest of their lives to 'damp down' their immune response.

However, Maxine, 41, from Wolverhampton, who had been in kidney failure for 15 years, was found to have immune system antibodies against the tissue types of all her family members, which seemed to rule them out as "living donors".

Other ways of removing these antibodies could not be used, as she had low blood pressure, and they could lower it further.

However, the new technique of cryofiltration did not present the same risk, and this is believed to be the first time it has been used to help a patient receive a non-matched organ.

The procedure involves circulating the blood plasma through a machine which heavily chills it, turning proteins and antibodies into a gel-like substance which can then be easily filtered out, before the plasma is re-warmed and returned to the patient.

Race against time

Dr Rob Higgins, a kidney specialist at University Hospitals Coventry and Warwickshire NHS Trust said: "Maxine would have gone blind within two years because of her low blood pressure, if she had not received a new kidney.

"This is another innovative measure we have implemented at the trust which opens the doors of donation for more kidney patients awaiting transplants."

Both Maxine, and her sister Michelle, who was the closest match available in the family, underwent the procedure five times before the transplant took place.

The operation, carried out in November, has already transformed Maxine's life.

She said: "I'm already feeling healthier - I am looking forward to being able to eat food I couldn't have at all before, like nuts and chocolate.

"Rob told me I was the first kidney patient in the world to try this technique which I thought was really exciting - it hasn't sunk in yet."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8500320.stm

Published: 2010/02/05 12:03:55 GMT

My big fat geek wedding: Tears, joy and oxytocin

- 10 February 2010 by **Linda Geddes**
- Magazine issue 2747.

Hormone surge (Image: Jon Hurst)

WE'D booked the venue, chosen the bridesmaids' dresses and even decided on the colours of the table decorations. But finding a refrigerated centrifuge and a ready supply of dry ice in rural south-west England was proving tricky. Then there were the worries about getting blood on my silk wedding dress, and what to do if someone fainted.

Organising a wedding can be stressful enough, but we had a whole extra dimension to consider. We were turning it into a science experiment to probe what happens in our bodies when we say the words "I do".

Our focus was the hormone oxytocin, sometimes dubbed the "cuddle chemical" for its role in promoting bonding, trust and generosity. The usual setting for investigating its effects is a lab where volunteers may be asked to play games that involve trust and generosity, for example. But how well do these contrived tests reflect what happens in real life?

I had written several articles about this hormone before, so my wedding last July seemed the perfect chance to see if it would surge in the ultimate public display of affection. I contacted leading oxytocin researcher Paul Zak, head of the Center for Neuroeconomics Studies in Claremont, California, and he leapt at the opportunity to translate his lab studies into real life.

The plan was to measure blood levels of oxytocin in the bride, groom, three close members of our families and eight friends both before and after the ceremony. OK, it was a small sample size, but Zak (pictured above) saw this as a pilot study that might point the way for future research, and perhaps even shed some light on why people stage public weddings in the first place.

Oxytocin is released from the pituitary gland in the brain, on the command of specialised nerve cells. It has long been known to help trigger childbirth as well as the release of milk during breastfeeding. And in the 1980s it transpired that, in American prairie voles at least, the hormone promotes pair-bonding

between mates. Zak and other research groups have since found oxytocin at work in a range of human social interactions, including strengthening the bond between mother and child and fostering closeness after sex. How the brain translates mental processes into signals to release oxytocin, however, remains mysterious.

Last year, Zak suggested a new role for oxytocin. The hormone rises in people watching a sad film clip; those who reported the greatest emotion experienced the biggest spike (*Annals of the New York Academy of Sciences*, vol 1167, p 182). What if oxytocin is the empathy chemical as well as the cuddle chemical? My wedding would be the perfect place to find out, I thought. If oxytocin really is the empathy chemical, those close to us might have a hormone surge as they witness our public pair-bonding.

Oxytocin may have a dark side, however. Work published last year hinted that oxytocin may also promote envy and the desire to gloat. Volunteers were asked to play a game of chance, in which people could win various sums of money. Those who inhaled a dose of oxytocin before playing the game felt more like gloating when they won the most money, and more envy when their opponent was ahead (*Biological Psychiatry*, vol 66, p 864).

One possibility is that oxytocin makes people more sensitive to social cues, says Salomon Israel, who studies decision-making at The Hebrew University of Jerusalem in Israel. "If you get a social cue to be more trusting, you're more trusting. But if you get a social cue that's threatening, you feel more threatened."

Whatever the answer, it is clearly difficult to measure complex emotions with simple games in the lab. For one thing, volunteers know their actions are being recorded, which may alter their behaviour. For example, people who share more money with other players are usually seen as more altruistic, but maybe they just care more about what people think of them. In reality, they might be quite selfish.

"We're not sure of the motivation that drives behaviour," says Richard Ebstein, also at The Hebrew University of Jerusalem, who studies the genetics of human behaviour. That is why scientists need to start looking at hormones such as oxytocin in real-life situations, he says. Like weddings.

That's where I came in. Once Nic, my husband-to-be, had resigned himself to turning the most romantic day of our lives into a science experiment, I realised there were several additional hormones we could check at the same time (see "Hormones gathered here today"). The obvious first choice was vasopressin, a hormone structurally related to oxytocin, which has been implicated in mate-guarding and jealousy in animals. You could say it's oxytocin's ugly cousin.

As the stress hormones cortisol and adrenocorticotropic hormone (ACTH) can affect the release of oxytocin, they went on the list, as did testosterone. A study in 2004 by neuroscientist Donatella Marazziti at the University of Pisa in Italy, and colleagues, had shown that levels of the male sex hormone dipped in men who have recently fallen in love, possibly to ensure they devote their energies to their partner, rather than looking for other women. Would a public exchange of vows have the same effect on testosterone? There was only one way to find out.

In the run-up to the wedding, several people said we were mad to run an experiment on our big day. For one thing, I'm not very keen on needles. I hoped I'd be too excited on the day to remember that. I waited till the day itself to confess my phobia to Zak, but he took it in his stride. An hour before the vows, the 13 volunteers were whisked into a dining room at the wedding venue, which had been temporarily converted into a lab. Amid a clacking centrifuge, needles and a tray of champagne cocktails for afterwards, two medically trained wedding guests removed 20 millilitres of blood. I survived the ordeal by looking away and chatting to my bridesmaids.

I hoped I'd be too excited on the day to remember that I'm not very keen on needles

Straight after the vows we did it all again. This time the first attempt to draw my blood failed and I had to be stuck twice. Zak later told me I looked about to pass out. "I've caught many a fainter," he says. "I was fiddling with the smelling salts in my pocket and was ready to catch you at the same time."

I managed to stay upright, however, and at last it was over. Zak spun the blood samples in the centrifuge (kindly loaned to us by the University of Exeter, UK) to separate the blood cells from the hormone-containing fluid, and then froze the fluid ready for shipping back to the US. Nic and I could forget about the experiment and enjoy the rest of our day.

A month later and the results were in. To my delight - OK, relief - in terms of oxytocin, our hypothesis proved correct. Both Nic and I experienced a rise in the hormone during the ceremony, as did the mother of the bride, the father of the groom and Nic's brother - all the relatives tested.

The results from our friends were mixed: two did and five didn't (see graph). One bridesmaid was excluded from the analysis because her readings were so high they were off the scale. This could have been the result of a faulty test, or perhaps she naturally has very high levels.

Group hug

Zak thinks the group oxytocin surge supports the theory that public weddings evolved as a way of binding couples to their friends and family, perhaps to help out with future child-rearing. This may explain why weddings are more common than eloping. It might also be why some people cry at weddings. "Maybe we cry for the same reason we cry at movies," he says. "We see ourselves in the couple."

Although the small sample size means the results are not statistically significant, we can still speculate about the trends seen. For example, I had the biggest spike in oxytocin, followed by my mother. "For every scenario we've looked at, women get the biggest rise," says Zak. "We know women are more empathic." It's also likely that women get more benefits from a marriage than men do and so may have more invested in it, adds Marazziti.

The other satisfying result was that we saw bigger spikes in family members than in friends. "It's what we would expect," says Ebstein. "Those who are genetically closest to you have a bigger investment in your wedding, and their oxytocin goes up more."

Not all the results fitted our predictions, however. Take vasopressin, the mate-guarding hormone. Zak thought we would see a spike in Nic's levels during the wedding ceremony - but instead we saw a fall. "Perhaps Nic didn't need to aggressively defend you as you have publicly committed to him," says Zak.

Nic's testosterone levels didn't behave either. Contrary to our hypothesis, it almost doubled during the wedding vows, with one male guest also experiencing a rise. Marazzeti has a possible answer: since testosterone is linked to libido, the sight of lots of women dressed up for the wedding may have been arousing.

As for the stress hormones, I didn't need the test results to know that mine were up. Although very high stress shuts down oxytocin release, moderate stress seems to promote it, which may be another reason why my oxytocin levels were boosted.

So do our results take us any closer to understanding why people choose to get married? Zak thinks so. "Maybe the reason we have these weddings is not just because of the emotional contagion - the empathy, the love - but because these emotions are linked to helping maintain the human race," he says.

By bringing our friends and relatives closer to us, we now have a host of people to mediate if we fight, or - should our oxytocin take us to the point of having children - to babysit. And I might just have cured my needle phobia.

Zak is already dreaming up larger field studies to see if he can replicate the results. "I'm convinced now that our studies in the lab have direct implications for the world outside," he says. "This was one of the highlights of my research career."

Hormones gathered here today

Levels of five hormones were measured before and after the wedding ceremony.

Oxytocin

Released from the pituitary gland in the brain during childbirth and breastfeeding, as well as social situations and sex. Recent studies suggest it increases trust and generosity, and perhaps empathy, too.

Vasopressin

Also released from the pituitary. In animals it is released during sex, and is also involved in male aggression, jealousy, territoriality and pair bonding. It is unclear if it also has this role in people.

Testosterone

Mainly released by the testes, but also from the adrenal glands. Promotes muscle growth, male sexual organs, secondary sex characteristics and libido. Studies suggest men's testosterone levels fall in the early stages of a relationship.

ACTH and cortisol

ACTH is released by the pituitary gland, triggering cortisol secretion by the adrenal glands. Moderate levels of these stress hormones promote oxytocin release, but high levels inhibit it.

Linda Geddes is a London-based reporter for New Scientist

http://www.newscientist.com/article/mg20527471.000-my-big-fat-geek-wedding-tears-joy-and-oxytocin.html?DCMP=NLC-nletter&nsref=mg20527471.000

Resurrection: ancient humans 'rise from dead'

- 18:20 10 February 2010 by **Ewen Callaway**

A brown-eyed man from 4400 years ago, dubbed Inuk, has become the first ancient human to have his complete genome sequenced, a Danish team announced today.

With the publication of a full Neanderthal genome expected soon and the woolly mammoth's a year ago, ancient genomics is starting to deliver on its enormous potential.

"Nobody really knows where the limits are," says Eske Willerslev, who has pioneered analysis of ancient DNA at the University of Copenhagen, Denmark, and led the team that sequenced Inuk's DNA. Egyptian and South American mummies and human ancestors more ancient than Neanderthals could be next – though success with remains this old is far from certain.

The new study reveals that Inuk – an Eskimo from the Saqqaq culture – had type A-positive blood, a disposition for male pattern baldness, was susceptible to ear infections and carried a gene variant that today is associated with brown eyes. More significantly, it suggests he was descended from a previously unknown migration from Siberia into North America, around 5500 years ago.

Ideal specimen

As ancient specimens go, Inuk was ideal for genome sequencing. Tufts of his dark brown hair were found in west Greenland, where the cold had prevented his DNA from degrading. And it's easier to rid hair of microbial decontamination than bone.

The next test for ancient genomics will be sequencing DNA from less pristine samples: those from regions of the world where the soil is not permanently frozen, or from bodies older than a few thousand years.

South American mummies are one possibility, says Willerslev. Native populations plummeted after the arrival of the conquistadors from Europe, so little is known about the diversity of the pre-Columbian people, descended from the first humans to settle there. Genetic studies could provide a clearer picture.

Other mummies may also prove amenable to genome sequencing. "It would be interesting to take hair from Tutankhamen", and other Egyptian mummies, says Carles Lalueza Fox, a palaeogeneticist at Pompeu Fabra University in Barcelona, Spain, who was not involved in the study.

Mummy genes

The first ancient DNA sequences to be gathered – 3400 base pairs from a 2400-year-old Egyptian mummy – was a proof of principle. A full genome sequence would be far more informative – perhaps explaining what killed King Tut, for instance.

At present, Inuk's is the only published ancient human genome. However, a team led by Svante Pääbo and Ed Green at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, will soon publish the complete genome sequence cobbled together from several Neanderthals, from between 38,000 and 70,000 years ago.

Neanderthals are not the only hominins whose genomes could be sequenced, says Willerslev. *Homo erectus*, a species that emerged in Africa about 2 million years ago, survived in east Asia until less than 100,000 years ago. If well-preserved bones can be found, a genome might be possible, Willerslev says.

Willerslev's laboratory has just received bones from Spain belonging to *Homo heidelbergensis*, the predecessor to Neanderthals. "We are basically starting on it right now," he says.

Peoples of the past

If these genomes ever materialise – and that's a big if – they could lead to a better understanding of how different hominid species are related, and when and where they branched off. If the genetic information is good enough, it may tell us something about the nature of past peoples – possibly even what they looked like.

Ancient human genomes could give us insights into the evolution of our own species, explaining when genes involved in disease and higher cognitive skills emerged.

But DNA isn't forever. As it ages, its long strands shred into ever smaller pieces. Eventually they become too small to reassemble, and all information is lost. "There seems to be a time horizon of 100,000 years or so under most preservation conditions during which intact DNA survives," Green says.

Stephan Schuster at Pennsylvania State University, who led the woolly mammoth genome project, thinks ancient genomics is already plateauing. Large chunks of Inuk's genome couldn't be filled in because his DNA had crumbled into small pieces. "We will face an uphill battle in trying to apply this to a large number of human remains," he says.

Journal reference: *Nature*, DOI: 10.1038/nature08835

http://www.newscientist.com/article/dn18509-resurrection-ancient-humans-rise-from-dead.html

Stinky flower is kept warm by yeast partner

- 10 February 2010 by **Shanta Barley**
- Magazine issue 2747.

Keep me warm (Image: Hemant Jariwala/Getty)

SYMBIOSIS comes in many flavours. Lots of animals trade protection or food in a mutually beneficial relationship. Now there is a flower that offers yeast its sugary nectar in exchange for warmth.

A European herb, the stinking hellebore, is the only plant discovered so far that relies on another organism to generate heat for it. Other plants, like the famous "corpse flower" whose blooms smell of rotting flesh, warm up by breaking down salicylic acid, or by tracking the sun's movement.

The stinking hellebore is the only plant discovered so far that relies on another organism for heat

Yeasts are common in a wide range of flower nectars, says Carlos Herrera of the Doñana Biological Station in Seville, Spain. It is deposited there by pollinating bumblebees, who pick it up from other flowers. Herrera and his colleagues took a sample of yeast from a local bumblebee in the Spanish mountains of Sierra de Cazorla. They injected the yeast into 37 "virginal" specimens of *Helleborus foetidus*, which had been covered in netting to keep pollinators away.

The team then compared the temperature of these flowers to the temperature of flowers with yeast-free nectaries. Flowers with yeasty nectar turned out to be 2 °C warmer on average, and up to 7 °C warmer when yeast densities were high. (*Proceedings of the Royal Society B*, DOI: 10.1098/rspb.2009.2252).

It's a significant spike in temperature for the plant, says Herrera. "But unless you have ultrasensitive fingertips, you won't notice it by touch." The yeast generates heat when it breaks down nectar sugars to grow.

What is in it for the plant? "The temperature rise may cause the flower to release a volatile which attracts more pollinators to the flower," says Sarah Gurr of the department of plant sciences at the University of Oxford. That is certainly what happens in another hot flower. The voodoo lily, a cousin of the corpse flower, has a temperature spike the day it blooms. As with the corpse flower, "this releases putrid amines, which smell like dead carcasses and attract pollinators to the flower, boosting its reproductive success", says Gurr.

http://www.newscientist.com/article/mg20527473.900-stinky-flower-is-kept-warm-by-yeast-partner.html

Complex smells make food more filling

- 09 February 2010
- Magazine issue 2746.

Making you full (Image: Buro Monaco/Plainpicture)

INCORPORATING complex smells into what you eat may produce more satisfying foods.

That's the conclusion of Rianne Ruijschop at Nizo Food Research in Ede, the Netherlands, and colleagues, who were investigating what effect different aromas have on the feeling of fullness.

The team added two different strawberry aromas to small pots of yoghurt and asked volunteers which was the most filling. Although to the untrained nose the smells were indistinguishable, one pot contained a simple aroma from one chemical, and the other a more complex aroma made up of 15 chemicals.

All 41 volunteers reported feeling more satiated after eating the yoghurt with the complex aroma. However, in a separate experiment, Ruijschop found that given a much larger supply, volunteers ate the same amount of both yoghurts (*Chemical Senses*, DOI: 10.1093/chemse/bjp086).

Jennifer Coelho, a clinical psychologist at Maastricht University in the Netherlands, says this is not surprising since we don't necessarily stop eating when we feel satiated.

Ruijschop admits that aroma is only one contributing component and hopes next to alter the texture of the yoghurt, with the aim of developing more satiating foods to help dieters eat less.

http://www.newscientist.com/article/mg20527464.800-complex-smells-make-food-more-filling.html

Lost leviathans: Hunting the world's missing whales

- 09 February 2010 by **Fred Pearce**

Magazine issue 2746.

Problems with numbers (Image: Josh Friedman/iStock)

THEY are enigmatic sea monsters - rare, magnificent beasts patrolling the ocean depths. Yet old chronicles tell of populations of whales hundreds of times greater than today. Such tales have long been dismissed as exaggerations, but could they be true? Have humans killed such a staggering number of whales?

New genetic techniques for analysing whale populations, alongside a growing archive of fresh historical analysis, suggest so. Taken together, they indicate that we have got our ideas about marine ecology completely upside down: whales may once have been the dominant species in the world's oceans.

This is not simply an academic question. It matters now more than ever before. Whale numbers have been recovering slowly since the end of large-scale hunting in 1986, but this global moratorium is only temporary. The International Whaling Commission, the club of mostly former whaling nations which maintains the ban, has rules that say it can reconsider hunting a given whale species if its population climbs back to more than 54 per cent of its pre-hunting levels. Right now, according to IWC estimates, Atlantic humpbacks and Pacific minkes may have recovered sufficiently to put them back in whalers' sights. But, crucially, such decisions rest on the veracity of the IWC's estimates of historical whale populations - 54 per cent of what, exactly? If the old salts' tales of whale abundance are true, it is way too early to be dusting off those harpoons.

Human pressure on whale stocks "was much earlier, much larger and much more significant than previously thought", environmental historian Poul Holm of the University of Dublin, Ireland, told a meeting of the Census on Marine Life (CML) project in 2009.

Most estimates of how many whales were present in the oceans before hunting began come from population modellers, many of them working for the IWC. These estimates are mostly based on combining the size of current populations with numbers caught in the past, as recorded in the logbooks of whalers. There are other ways to calculate historical whale numbers, though.

So far, genetic evidence has received the most attention, in particular the publication of a controversial study in 2003 by Stephen Palumbi and Joe Roman of Stanford University's Hopkins Marine Station. This

study's high numbers appeared to blow IWC historical estimates out of the water, particularly for humpback whales (*Science*, vol 301, p 508).

The pair had investigated whales for signs of genetic variation. Geneticists claim to be able to use this to estimate the size of the population in the past since large populations tend to accumulate diversity through random DNA mutations and breeding, while small populations lose it through inbreeding. The results were dramatic.

Resume the hunt

The IWC believed that before large-scale whaling began, the North Atlantic was home to about 20,000 humpback whales. With a current population of about 10,000 and rising, this meant that under the 54-per-cent rule hunting could soon resume. But Roman and Palumbi estimated the pre-exploitation population was more than 20 times as great, at 240,000. Globally, they suggested, there may have once been 1.5 million humpbacks, rather than the 100,000 estimated by the IWC.

Unsurprisingly, Palumbi got a hostile reception when he presented these figures to the IWC in 2004, and the numbers remain controversial. One leading expert, on condition of anonymity, told *New Scientist* that the estimates were "ridiculous" and privately accused Palumbi of being "more interested in getting papers into *Nature* and *Science* than in getting it right".

There are problems with the analysis. It assumes that the particular whale population under scrutiny never bred with others. Critics point out that the now-distinct humpback populations of the North and South Atlantic may well have once done just that. It could be that Roman and Palumbi have inadvertently estimated the entire Atlantic humpback population, or even the global population rather than that in just the North Atlantic.

Palumbi and Roman are not alone, however. Charles Scott Baker, a conservation geneticist at Oregon State University in Newport, has used DNA analysis to investigate minke whales. IWC estimates put their number today near their historical levels of around 600,000 globally. But Scott Baker reckons that as recently as 300 years ago there were probably close to 1.5 million of them. That suggests its recovery is still at an early stage.

Can these conflicting numbers be reconciled? Historical abundance is estimated using a combination of the current population and the total historical catch. The problem is that nobody can be sure how many whales were taken in the past. Some estimate that the total catch for the 20th century was about 4 million. But official whaling records are incomplete, especially post-war logs.

The most dramatic revelations have come from the archives of the former Soviet Union, which carried out massive illegal harvesting of whales - especially in the 1950s and 1960s - while sending false logbook records to the IWC. Memoirs of Russian whaling inspectors published in the past two years reveal that from 1959 to 1961, Soviet whaling fleets killed 25,000 humpback whales in the Southern Ocean, while reporting a catch of just 2710. This continued well into the 1970s according to new revelations at an IWC conference in 2009 by one of the original whistle-blowers, Yuri Mikhalev of the South Ukrainian Pedagogical University in Odessa, Ukraine.

Earlier records, where they exist, may be more reliable. Tim Smith, who heads the World Whaling History project, says that "the keepers of logbooks [in the 19th century] had no incentive and little latitude to under-report catches". Even so, there may still be huge gaps in the data used by today's modellers. British whaling records were often dramatically incomplete, for example. Jennifer Jackson of Oregon State University in Newport has studied right whales off New Zealand, which were heavily hunted in both the 19th and 20th centuries. She discovered that British whalers took an estimated 10,000 whales in the South Pacific that had simply not been included in previous catch estimates.

But even after such data gaps are accounted for, the numbers still cannot be reconciled. So what else may have been going on?

Roman points out that whalers' logbooks, even if scrupulously kept, only report some of the killings. For one thing, many whales are killed but never landed. Population modellers have traditionally added a few percentage points to allow for this, but many believe that only a minority of the whales attacked by vessels were killed, landed and logged - a large number escaped their hunters to die later from harpoon injuries. Others died in fishing nets, were struck by ships or used as target practice by naval vessels, says Roman.

A large number of whales escaped the hunters to die later from harpoon injuries

Ancient hunters

There is also growing evidence of massive damage to whale populations inflicted by humans long before the industrial era of explosive harpoons and factory ships. Some 70,000 records of whale catches and sightings assembled by the History of Marine Animal Populations project, part of the CML, suggest the impact of pre-industrialised hunting on whale stocks was much greater than previously assumed.

Basque and Japanese fishermen were catching right whales 1000 years ago. And for centuries, many other island and coastal communities have harvested the creatures. Whaling was the first global industry, says marine biologist Callum Roberts of York University in the UK. Whalers were hunting deep in Arctic waters long before explorers showed up. When Darwin reached the Galapagos Islands in 1835, they were already overrun with American vessels pursuing sperm whales.

According to Robert Allen of the University of Oxford, it now appears that many whale populations in the northern hemisphere were ravaged in the 17th and 18th centuries by whalers employing hand-held harpoons and sheer manpower. Back then, whales were essentially "floating oil wells", providing oil for candles, street lamps and machinery, as well as ingredients for perfumes, plus bones for everything from corsets to fishing rods.

Whales were 'floating oil wells', providing oil for candles, street lamps and machinery

The downfall of the Arctic bowhead whale is the best documented. Thousands of Dutch whaling ships headed into the Arctic in the 17th and 18th centuries to catch bowheads off Spitsbergen, until the population collapsed. Whaling then moved to the waters off Greenland where a frenzied hunt soon wiped out what had been the biggest whaling ground in the world. Today there are only about 1000 bowheads swimming west of Greenland - and none at all between Greenland and Spitsbergen, says Allen.

The emerging history of pre-industrial whaling, and what it suggests about past whale numbers, raises some important questions. Not just about the wisdom of a return to commercial whaling, but also about ocean life in general. Jeremy Jackson of the Scripps Institution of Oceanography in San Diego says the hunting of whales has fundamentally reorganised ocean ecosystems. Today, ocean biomass is dominated by small creatures. But he says this "trophic pyramid", with only a tiny tip of large creatures, may not be natural. Before we intervened, he says, the pyramid was probably the other way up, with large beasts dominating the biomass.

Keeping these big beasts fed would be possible if the turnover of their smaller prey species was fast enough to ensure that fresh food was constantly being produced. And rather than devouring an ecosystem, a greater number of whales might help feed it: when a whale dies, its carcass sinks to the seabed where it could feed a local population of scavenging species for up to 80 years. Peter Karieva, chief scientist at conservation charity The Nature Conservancy in Seattle, Washington, says there is evidence that the decline of sperm whales in the tropical Pacific has moved the entire ecosystem towards domination by

species like squid. We don't know what was lost with the whales - or what else might reappear if their numbers soared.

All this new research is putting the scientific credibility of the IWC under increasingly scrutiny. Some hope that the issues might be resolved at the IWC's annual meeting in Agadir, Morocco, in June this year. Don't hold your breath: "The discrepancies are unlikely to be resolved in the scientific committee of the IWC," says IWC scientist Sidney Holt.

Until now, says Jeremy Jackson, the widespread anecdotal evidence of huge numbers of whales and other large animals on the planet has been systematically downgraded by scientists simply because it cannot be proved. He calls the process "scary, unbridled anti-historical determinism". The result, he says, is that "we deny the once-great existence of anything we killed more than a century ago".

The new ecological perspective on the past abundance of whales is, like Palumbi's work, controversial. Nevertheless, the ever-growing body of historical evidence is siding with the DNA. It suggests that even the most "recovered" of today's whale populations are mere ghostly reminders of their former dominance.

The whale's past may be shrouded in mist, but one thing's for sure - their future is in our hands.

Fred Pearce is environmental consultant for New Scientist

http://www.newscientist.com/article/mg20527461.200-lost-leviathans-hunting-the-worlds-missing-whales.html

At last we will know how bright the stars really are

- 09 February 2010 by **David Shiga**

Magazine issue 2746.

One step away from dark energy (Image: Observatory Edinburgh/AAO/SPL)

LIGHT is the bedrock of astronomy, so it may come as a surprise that astronomers don't have a very good handle on measurements of brightness. That is set to change, however, as the antiquated brightness scale undergoes a long-overdue upgrade that could help to reveal the true nature of dark energy.

More than 2000 years ago, the Greek astronomer Hipparchus devised a scale ranking the apparent brightness of different stars. Today, astronomers use much the same system, measuring brightness relative to a handful of standard reference stars. The trouble is, the reference stars' brightness is not known very accurately, and measurements of it have not kept pace with developments in detector technology. For example, the most accurate measurements of the bright star Vega date back to the 1970s. "It's surprising. There has been relatively little work on that in the past couple of decades," says Gary Bernstein of the University of Pennsylvania in Philadelphia.

The most accurate measurements of the bright star Vega date back to the 1970s

To redress this, a team led by Mary Elizabeth Kaiser of Johns Hopkins University in Baltimore, Maryland, is planning to launch a rocket-borne telescope to make the most accurate measurements yet of the reference stars' brightness (arxiv.org/abs/1001.3925). Called the Absolute Color Calibration Experiment for Standard Stars (ACCESS), the NASA-funded mission will lift off in a year or two and make four suborbital flights, each taking it above Earth's distorting atmosphere for a few minutes at a time.

During these brief jaunts, ACCESS will gauge the brightness of four common reference stars - the sky's brightest star, Sirius; Vega; and a couple of much dimmer ones - to a precision of 1 per cent or better. That is twice the accuracy of current measurements, an advance that will be possible thanks to the calibration of the telescope's sensors with artificial light sources before launch.

The measurements ACCESS makes will serve as a benchmark to calibrate the observations of other telescopes. This will allow the brightness of supernovae and other objects to be measured more accurately.

Such precision will be key to finding out the secrets of dark energy, a mysterious entity that is causing the universe to expand at an ever faster rate. The existence of dark energy was deduced in 1998 when astronomers noticed that distant supernovae were fainter - and thus farther away - than expected.

Astronomers still don't know where dark energy comes from. It could spring from a fundamental new force, or it might point to a flaw in our understanding of gravity. To better understand it, researchers are examining the history of cosmic expansion, searching for slight variations in the expansion rate over time. This requires more accurate measurements of the brightness of supernovae at different cosmic epochs.

ACCESS team member Adam Riess of Johns Hopkins University, one of dark energy's discoverers, says subtle errors can crop up when combining brightness data from multiple telescopes, potentially misleading astronomers about the nature of the acceleration. "You could think that dark energy is changing with scale or time, but it's only an artefact of the fact that your observatories have not all used the same reference point," he told *New Scientist*.

The ACCESS mission will help astronomers avoid this pitfall, he says. "It doesn't measure dark energy itself but it makes your scale more accurate."

ttp://www.newscientist.com/article/mg20527464.100-at-last-we-will-know-how-bright-the-stars-really-are.html

Helium clue found in echo of the big bang

- 08 February 2010 by **Rachel Courtland**

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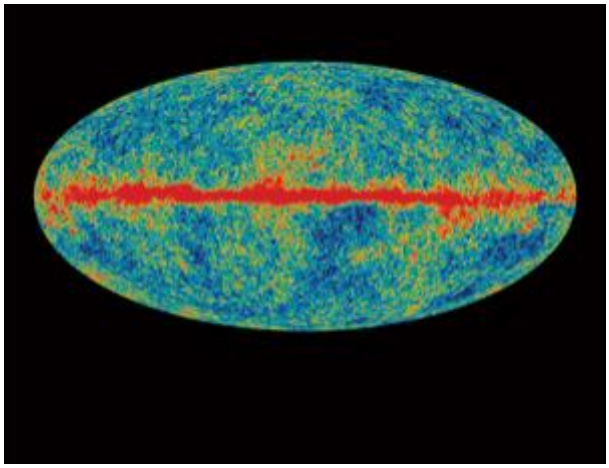


Gradually giving up its secrets (Image: WMAP Science Team)

THE subtle signal of ancient helium has shown up for the first time in light left over from the big bang. The discovery will help astronomers work out how much of the stuff was made during the big bang and how much was made later by stars.

Helium is the second-most abundant element in the universe after hydrogen. The light emitted by old stars and clumps of hot pristine gas from the early universe suggest helium made up some 25 per cent of the ordinary matter created during the big bang.

The new data provides another measure. A trio of telescopes has found helium's signature in the cosmic microwave background (CMB, pictured), radiation emitted some 380,000 years after the big bang. The patterns in this radiation are an important indicator of the processes at work at that time. Helium affects the pattern because it is heavier than hydrogen and so alters the way pressure waves must have travelled through the young cosmos. But helium's effect on the CMB was on a scale too small to resolve until now.

By combining seven years of data from NASA's Wilkinson Microwave Anisotropy Probe with observations by two telescopes at the South Pole, astronomers have confirmed its presence. "This is the first detection of pre-stellar helium," says WMAP's chief scientist, Charles Bennett.

These observations are in line with earlier measurements, although less accurate. "I think CMB measurements will surpass them eventually," says team member David Spergel.

More accurate numbers could reveal how quickly the early universe expanded. Helium forms from the interaction between protons and neutrons. This is constrained by the number of available neutrons, which would have dropped during the time the brand new universe was expanding as they decayed into protons. So the amount of helium that formed places important limits on how quickly this expansion took place. That could help test theories that postulate extra dimensions or as-yet-unseen particles.

Better data should be available in the next few years. The European Space Agency's Planck satellite, which launched last year, is poised to measure the amount of helium even more precisely.

http://www.newscientist.com/article/mg20527463.700-helium-clue-found-in-echo-of-the-big-bang.html

Weight scale for atoms could map 'island of stability'

- 21:15 10 February 2010 by **Rachel Courtland**

The mass of an atom heavier than uranium has been measured for the first time (Image: bjearwicke/stock.xchng)

Hunting for the universe's heaviest atoms just got a little easier, thanks to a new technique that directly measures the mass of elements heavier than uranium. The method could help find an "island" of unusually stable elements that is thought to extend beyond the current end of the periodic table.

Uranium, which contains 92 protons, is the heaviest element known to occur in nature. But researchers have synthesised a number of even heftier elements, with as many as 118 protons.

These extreme atoms are quite short-lived – many fall apart just milliseconds after they are created. But nuclear theorists suspect that a class of 'super-heavy' atoms, boasting the right combination of protons and neutrons, could have lifetimes of decades or longer (see *Hunting the biggest atoms in the universe*).

Elements in this so-called island of stability could act as powerful nuclear fuel for future fission-propelled space missions. They might also be exhibit useful new chemical properties. Element 114, for example, has shown hints that it behaves like a gas at room temperature even though it should be a member of the lead family on the periodic table.

But no one knows where the island of stability lies; some models predict it is centred on atoms with 114 protons, while others put it near atoms with 120 or 126 protons.

The uncertainty arises because it is not clear how strongly the nuclei of super-heavy atoms are bound together, and thus how stable they are. Determining this 'binding energy' has been difficult because super-heavy atoms are short-lived; experimentalists have had to estimate it by looking at the atoms produced when a super-heavy atom breaks apart.

Now a team led by Michael Block of the GSI Helmholtz Centre for Heavy Ion Research in Darmstadt, Germany has demonstrated a direct way of measuring the mass of particles heavier than uranium.

Binding energy

Because mass and energy are equivalent, as described by Einstein's famous equation $E = mc^2$, determining the mass of an atom indicates how strongly its nucleus is bound together.

To make the mass measurement, the team used a device called a Penning trap, which employs electric and magnetic fields to confine atoms.

The trap was used to weigh atoms of nobelium, an element that contains 102 protons, 10 more than uranium. Like other 'artificial' elements, the nobelium atoms were created by colliding a stream of lighter atoms with a target.

The key advance was finding a way to slow down the nobelium atoms before they entered the trap – a feat the team accomplished by first injecting the atoms into a chamber filled with helium gas.

Hard to produce

Measuring the mass of other elements could help theorists begin to differentiate between competing models for the structure of super-heavy nuclei. "It will [give us] important experimental evidence that can be used to confront nuclear structure theories," says Walter Loveland of Oregon State University in Corvallis, who was not associated with the study.

"There's nothing in the method that would prevent you from moving significantly up the periodic table," he says. But in practice, it will likely be difficult to do with the heaviest atoms because they are so hard to synthesise in the first place. For example, nobelium atoms can be created at the rate of one per second by shooting other atoms at a target, but super-heavy elements, atoms with 104 or more protons, are currently produced at the rate of one per week, if that.

If the technique can be extended to super-heavy elements, it could eventually help identify inhabitants of the island of stability when they are created.

These atoms would be produced in such small quantities and would decay so slowly that they would be extraordinarily hard to detect by their decay products alone. "We need another way to identify them," Block told *New Scientist*. "The mass in principle can be considered as unique as a fingerprint."

Journal reference: *Nature* (vol 463, p 785)

http://www.newscientist.com/article/dn18510-weight-scale-for-atoms-could-map-island-of-stability.html

Australia's rain may have moved to Antarctica

- 10 February 2010
- Magazine issue 2747.

A NEW attempt to explain the 40-year drought that has blighted the nation says it may be linked to heavy snowfall over Antarctica.

Tas van Ommen and Vin Morgan of the Australian Antarctic Division studied snowfall records in ice cores from East Antarctica's Law Dome. They found that in the last few decades, its snowfall rates far exceeded anything in the past 750 years. The timing matches the Australian drought (*Nature Geoscience*, DOI: 10.1038/ngeo761).

From the past 60 years of pressure and moisture data over the combined region, the team also found a link between the patterns of two atmospheric moisture "corridors". One has been blowing dry air from the Southern Ocean over south-west Australia since the beginning of the drought, whilst another is shifting moist air south towards Antarctica.

Van Ommen says a pressure system that lies between Antarctica and Australia may be the lynchpin for this atmospheric see-saw. The pressure system has been strengthening since the mid-20th century, making the weather patterns in each destination more extreme. It is unclear whether or not climate change is involved.

http://www.newscientist.com/article/mg20527474.800-australias-rain-may-have-moved-to-antarctica.html

New black hole simulator uses real star data

- 19:51 09 February 2010 by **Hazel Muir**

A new interactive program reveals the spectacular light show you'd see if you dared to wander close to a black hole. It demonstrates how the extreme gravity of a black hole could appear to shred background constellations of stars, spinning them around as though in a giant black washing machine.

The program's creators say it could be an excellent tool to familiarise people with the weird ways that black holes warp light. "It's useful for people to play around with the parameters to study how, for instance, a black hole would distort the constellation Orion," says Thomas Müller of the University of Stuttgart in Germany.

A black hole forms when a massive star explodes at the end of its life, the core collapsing to a point with huge density and an enormous gravitational pull. Even at a safe distance from the black hole, its gravity can distort the apparent positions of background stars, an effect called gravitational lensing.

Last year, scientists at the University of Colorado demonstrated a video of what you'd see if you fell into a black hole.

Now Müller and Stuttgart colleague Daniel Weiskopf have gone a step further, creating a program that lets you alter various inputs to tour a black hole's environs.

Real data

The program incorporates the real positions of around 118,000 stars mapped by the European Space Agency's Hipparcos satellite. Users can choose their distance from a black hole, then go into orbit or plunge straight in.

At the start of each tour, you see a black circle that marks the hole's event horizon – the boundary from which nothing, not even light, can escape. The light of background stars distorts as it passes close to the event horizon.

This example simulation shows the view while orbiting a black hole at a radius five times larger than the event horizon. In the background, the constellation Orion moves towards the black hole from the right, then gets shredded and spun around.

'Like a mirror'

"The constellation approaches the black hole, then you see stars like Betelgeuse – the left shoulder of Orion – appear twice, on the right and left sides of the black hole," Müller told **New Scientist**. "It's as if the black hole is like a mirror."

As well as accounting for gravitational lensing, the simulator shows how star colours would change near a black hole. The intense gravity makes background stars appear redder because it saps the energy of photons passing near the event horizon; the photons stretch to longer, redder wavelengths as they "climb out" of the gravitational trap.

But this effect is counteracted by your speed when you're falling freely towards a black hole – travelling at nearly the speed of light, stars in the black hole's backdrop turn bluer due to the Doppler effect. In a simulation mimicking such unhindered freefall, the light of the entire universe appears concentrated into a bright ring once you reach the middle of the black hole.

Journal reference: *American Journal of Physics* (DOI: 10.1119/1.3258282)

http://www.newscientist.com/article/dn18498-new-black-hole-simulator-uses-real-star-data.html

World's most precise clock created

- 17:21 08 February 2010 by **Jeff Hecht**

The new record-holder for the most precise timekeeper could tick off the 13.7-billion-year age of the universe to within 4 seconds.

The optical clock monitors the oscillation of a trapped atom of aluminium-27. It is more than twice as precise as an earlier version, reported in 2008, and was built at the National Institute of Standards and Technology in Boulder, Colorado. "It's extremely impressive," says Patrick Gill of the UK's National Physical Laboratory, who was not involved with the work.

The second is currently defined by caesium atomic clocks, but optical clocks promise higher precision because their atoms oscillate at the frequencies of light rather than in the microwave band, so they can slice time into smaller intervals. Such clocks could help spot tiny changes in physical constants over time.

Journal reference: arxiv.org/abs/0911.4527

http://www.newscientist.com/article/dn18493-worlds-most-precise-clock-created.html

Rob Hopkins: Getting over oil, one town at a time

- 07 February 2010 by **Jessica Griggs**
- Magazine issue 2746.

Community-led approach (Image Stephen Prior)

The founder of the Transition Towns movement explains why he is optimistic that we can survive peak oil and minimise climate change.

Can you tell me more about the Transition Towns movement?

A Transition Town is formed when a group of individuals gets together to ask how their community can mitigate the effects of a potential reduction in oil and drastically reduce their carbon emissions to offset climate change. The scheme has become so successful we now have 250 official Transition Towns and Cities worldwide, with many more interested in becoming involved.

Transition Towns have set up bartering systems like local currencies and seed exchanges; what other initiatives are they taking?

In England, Totnes and Lewes are setting up the first energy companies owned and run by the community - Transition Stroud has written the local council's food strategy. One group in Scotland has managed to get access to land for new allotments in their area and the first university scheme has just been set up at the University of Edinburgh.

You're about to launch an Energy Descent Action Plan for Totnes. What is it?

It's based on the idea that the way out of our current economic situation isn't to carry on as normal. We have to look at the local economy and ask what a town could look like in the next 20 years if oil production has peaked - "peak oil" - and climate change is a reality. So the vision for food might be that people have a local food economy with more urban agriculture employing local people. We then work out how we might achieve this. For instance, we look at the land available, how it is used and to what degree the area could be self-reliant.

When do you think we're going to run out of oil?

We're probably not going to run out of oil in our lifetime. There won't be a mythical moment when someone in Leicestershire pours out the last drop into their car and that's it; what matters is the point at

which we move from having more cheap oil available to having less cheap oil available each year. It's the shift from a time when our economic success, our personal prowess and wealth is directly linked to how much fossil fuel we consume, to a time when our degree of oil dependency is a vulnerability. By 2013 we will be entering a time of increasing volatility in terms of price and availability. For an economy which is designed to function on a plentiful supply of cheap oil, that's a historic transition.

Are there specific characteristics that make a Transition Town more likely to succeed?

We have a thing called the "cheerful disclaimer" - which means we have no idea if the idea is going to work or not. It's an invitation to have a go.

If the majority of people in a Transition Town were on-board, are they more likely to survive peak oil or climate change?

There are no guarantees that your community will be immune to climate change. But I think human beings have an in-built survival mechanism.

Profile

Rob Hopkins taught a permaculture course in Ireland before founding his community-led response to peak oil and climate change, the Transition Towns movement

http://www.newscientist.com/article/mg20527466.000-rob-hopkins-getting-over-oil-one-town-at-a-time.html

Sun-powered water splitter makes hydrogen tirelessly

- 13:59 11 February 2010 by **Colin Barras**

Sunlight + water = hydrogen gas, in a new technique that can convert 60 per cent of sunlight energy absorbed by an electrode into the inflammable fuel.

To generate the gas Thomas Nann and colleagues at the University of East Anglia in Norwich, UK, dip a gold electrode with a special coating into water and expose it to light. clusters of indium phosphide 5 nanometres wide on its surface absorb incoming photons and pass electrons bearing their energy on to clusters of a sulphurous iron compound.

This material combines those electrons with protons from the water to form gaseous hydrogen. A second electrode – plain platinum this time – is needed to complete the circuit electrochemically.

New benchmark

Organic molecules have been used before to perform the same feat. But they are quickly bleached by the sunlight they are collecting, rendering them inefficient after a few weeks.

The inorganic materials used in the University of East Anglia's system are more resilient. Their first generation proof of concept is "a major breakthrough" in the field, they say, thanks to its efficiency of over 60 per cent and ability to survive sunlight for two weeks without any degradation of performance.

"In fact the 60 per cent figure is probably a worst-case scenario," says Nann. "This is still a preliminary study."

Bigger net

That high efficiency is largely thanks to the indium phosphide clusters being better at grabbing photons than organic molecules. "Think of them as a butterfly net for catching photons," says Nann.

By the standard measure of the probability that a material will absorb a photon that hits it, each cluster is 400 times better at netting photons than organic molecules used in previous systems. "That's why it works so well," says Nann.He and colleagues now plan to refine the system, including lowering the cost by making it with less expensive materials. "There is no major reason for using gold or platinum," he says: those materials were used simply because they are common in the laboratory.

Welcome result

The Nann team's experiment has been welcomed by others in the field. "It's a significant result," says Vincent Artero at the Joseph Fourier University in Grenoble, France. There is still room to improve efficiency and reduce materials costs, but "my overall appreciation of this work is highly positive, both regarding the scientific level and the promises that are held by the new result", he says

Licheng Sun at the Royal Institute of Technology in Stockholm, Sweden, agrees. "It will certainly [provide] future research topics for water splitting," he says.

Journal reference: *Angewandte Chemie International*, DOI: 10.1002/anie.200906262

http://www.newscientist.com/article/dn18511-sunpowered-water-splitter-makes-hydrogen-tirelessly.html

Organic crystals promise low-power green computing

- 18:00 10 February 2010 by **Colin Barras**

A saffron-coloured crystal could provide a step towards greener electronics.

Some types of low-power computer memory store information using metals that are ferroelectric, meaning they form positive and negative poles when placed in an electric field. However, many of the more common metals used are either rare or toxic.

Now Sachio Horiuchi at the National Institute of Advanced Industrial Science and Technology in Ibaraki, Japan, and colleagues have discovered ferroelectric behaviour in crystalline croconic acid, which contains just carbon, oxygen and hydrogen.

Croconic acid was discovered 170 years ago but crystallised for the first time within the past decade. When Horiuchi's team applied an electric field to the crystals at room temperature they could reverse its electric polarity.

The researchers noticed a small time lag between removing the field and reversal of the crystal's polarity. This is "typical of ferroelectrics", says Horiuchi, and a "direct indication of the ability to store and switch an electrical polarisation". The finding suggests croconic acid could be used in organic electronics.

Marty Gregg at Queen's University Belfast, UK, says that there already exist some organic polymers with ferroelectric properties, including polyvinylidene fluoride. "[But] the availability of more organic ferroelectric systems than the PVDF-like systems is pretty cool, as it opens up more opportunities for all organic devices than had previously been available."

Although he points out that the Horiuchi team's results suggest croconic acid might switch polarity too sluggishly for use in ferroelectric RAM, "the work will, I think, nevertheless be received with some excitement".

Journal reference: Nature, DOI: 10.1038/nature08731

http://www.newscientist.com/article/dn18503-organic-crystals-promise-lowpower-green-computing.html

Beware of geoengineering using volcanoes' tricks

- 07 February 2010

Magazine issue 2746.

Starving the oceans of oxygen (Image: NASA)

WE HACK the climate at our peril. Volcanoes spewed so much sulphate into the atmosphere 94 million years ago that the oceans were starved of oxygen and 27 per cent of marine genera went extinct. Geoengineering our climate could inflict a similar fate on some lakes.

So claims Matthew Hurtgen at Northwestern University in Chicago, who with his colleagues measured sulphur isotopes in sediments on the floor of the Western Interior Seaway. The WIS was a vast body of water that divided the continent of North America down the middle at the time. The team also developed a model to simulate the impact of volcanoes on ocean chemistry.

Before oceanic oxygen levels tumbled, something caused a big change in atmospheric sulphate levels. "That something was probably volcanoes," says Hurtgen. He says their sulphate emissions triggered vast phytoplankton blooms and much of the ocean's oxygen was gobbled up as these died and decomposed. According to the team's model, oceanic sulphate was extremely low prior to the eruptions (*Nature Geoscience*, DOI: 10.1038/ngeo743).

This has implications for geoengineering, says Hurtgen. "Like the mid-Cretaceous ocean, most modern lakes are poor in sulphate, so it's possible that geoengineering the climate [using sulphate aerosols to reflect sunlight] could trigger blooms and ultimately anoxia in some lakes."

http://www.newscientist.com/article/mg20527464.400-beware-of-geoengineering-using-volcanoes-tricks.html

Act early in life to close health gaps across society

- 11 February 2010 by **Andy Coghlan**
- Magazine issue 2747.

Giving a child the best start in life (Image: Keiji Iwai/Getty)

THAT a lack of wealth all too often translates into poor health may seem painfully obvious. But now a review of health inequalities in England reveals that such disparities don't just disadvantage the least well-off. The review also suggests some strategies to tackle the inequalities. These remedies should apply the world over, including in the US, where health and wealth inequalities can be especially stark.

Commissioned by the UK government, the review was headed by Michael Marmot of University College London, who most famously showed that British civil servants at the bottom of the organisational pile were much more likely to suffer coronary heart disease than those at the very top. In his latest work, Marmot uses census data from across England to show that these health inequalities don't just exist between the richest and the poorest.

For example, even if you exclude the richest and poorest 5 per cent of people in England, the richest remainder can expect to live 6 years longer than the poorest, and enjoy an extra 13 years free of disability. Marmot says action to reduce health inequalities should take place right across society, not focus solely on the poor. "It's not rich versus poor, because it's a social gradient," he says.

What's more, the most productive time to intervene to create a healthier society is childhood, Marmot says. That children who start out with well-off, well-educated parents are likely to be healthier would seem to be something of a no-brainer. But the fates of 17,200 UK babies monitored since they were born in the same week in April 1970, and highlighted in Marmot's review, make compelling evidence.

It turns out that babies who had low IQs at 22 months and were born to richer, better educated parents caught up by the age of 6 with children who started with high IQs but whose parents were poorer and less educated. By age 10, the children in the higher socio-economic group were forging ahead on intelligence tests while those in the lower socio-economic group fell further and further behind (see diagram). "It shows that the social is trumping the biological," says Marmot. "We can change that, and that's why I'm optimistic."

He also finds that children in poorer families miss out on pre-school reading, socialising and physical exercise (see diagram). This disadvantage leaves them trailing far behind when they start school (see diagram) and they seldom recover (see diagram).

Diagrams: Being behind can lead to behavioural and emotional problems. What's more, the UK spends less on children during early childhood than at any other stage of their education

Such inequalities are not confined to the UK. A report in April 2009 by the US-based Robert Wood Johnson Foundation concluded that interventions most likely to improve the health of all Americans were "programs that promote early childhood development and that support children and families". A report from Brazil recommended prioritising "actions related to health promotion of children and adolescents".

"We look forward to assessing how to adapt the policy recommendations for England to the rest of the world," says Rüdiger Krech, director of the WHO's department of ethics, equity, trade and human rights. He agrees that giving every child the best start in life "is critical in setting the foundation for a lifetime of health and successful contribution to society".

What can be done to ensure this? One option is to extend maternity or paternity leave, suggests Marmot. Another is to help struggling parents by providing extra services and information.

http://www.newscientist.com/article/mg20527473.800-act-early-in-life-to-close-health-gaps-across-society.html

Psychiatry's draft new 'bible' goes online

- 15:49 10 February 2010 by **Peter Aldhous**

There's an update in the works (Image: Michelle Adamsky/Swellxelle/Flickr)

A single diagnosis for autism and related disorders, a new label for many children now described as bipolar, and the classification of binge eating as a medical condition all figure in proposals unveiled today by the American Psychiatric Association (APA).

After more than two years of deliberation, the suggestions from 13 expert groups that have been working on the next edition of the *Diagnostic and Statistical Manual of Mental Disorders* are now available online. Interested parties have until 20 April to comment. The APA will then revise its proposals and launch a series of field trials to test the new diagnoses.

The new volume, known as *DSM-V* and scheduled for publication in 2013, has become a focus of controversy. Psychiatrists who led previous revisions of the manual are among those who have criticised its proposals. In particular, they have warned that some of the changes under consideration could cause millions more people to be given potentially risky psychoactive drugs.

Blurred boundaries

The APA's leaders reject those criticisms, pointing out that one goal of the rewrite is to streamline psychiatric diagnosis. For instance, they propose removing various subtypes of schizophrenia, and collapsing a variety of personality disorders into one condition. "We are likely to end up with fewer disorders in *DSM-V* than in *DSM-IV*," says Alan Schatzberg, the association's president.

This does not reassure those who are concerned that the new criteria may blur the boundaries between normal behaviour and mental illness. The most controversial suggestion is for new "risk syndromes" for types of psychosis and dementia.

The possible adoption of risk syndromes for psychosis has caused particular alarm, given the side effects of antipsychotic drugs – which include weight gain and loss of libido – and the fact that only around 30 per cent of people identified as being at risk will go on to develop psychosis within two years.

"They don't seem to be that concerned about excluding false positives," complains Robert Spitzer, a retired psychiatrist who chaired the *DSM-III* revision.

William Carpenter of the University of Maryland in Baltimore, who chairs the *DSM-V* work group on psychosis, says that over the next two years his group will review the available research to consider whether psychosis risk should be included in *DSM-V*, or instead be listed in an appendix, to encourage more studies.

Prolonged grief

The dementia risk category, called "minor neurocognitive disorder", is intended to identify people whose mental decline might be slowed if they are encouraged to engage in intellectual activities and physical exercise.

Michael First, a psychiatrist at Columbia University in New York, is concerned that it will instead serve as a flag to health insurers, who may end up denying coverage to people identified in this way, to avoid having to bear the cost of expensive treatment years later. "Insurance companies want to reduce their risk of having to pay out," he says.

With the proposals now published online, critics have a chance to weigh in before the start of field trials, planned for July. "The good news is that there is something to look at," says Spitzer. "The bad news is that there's not an enormous amount of time to make changes."

Some potential revisions are still missing, as the necessary work was not completed in time. These include a possible new diagnosis of "prolonged grief", to recognise the plight of those who remain stricken by the death of a loved one.

Significant proposals

Below we outline other significant areas where proposals are now open for public comment:

Binge eating disorder

Do you consume unusually large amounts of food at least once a week, and feel a loss of control, embarrassment and guilt? Has it been this way for at least three months? If so, you meet the criteria for the proposed new condition of "binge eating disorder". The impetus for its inclusion comes in part from a 2007 study which suggests that it is as common in the US as anorexia and bulimia combined.

But its high frequency is exactly what concerns psychiatrist Michael First, who wonders if normal behaviour is being turned into a psychiatric disease. "Once a week for three months seems like a low threshold," he says. "How abnormal is that?"

Possible treatments for binge eating include not only cognitive-behavioural therapy, but also antidepressants and appetite suppressants, so drug companies have an interest in whether binge eating gets included in *DSM-V*.

Autism spectrum disorders

The work group dealing with neurodevelopmental disorders wants to cut through the confusion surrounding autism and related conditions. In their place it wants to create a single diagnosis to cover the entire spectrum.

At present, children who display problems with social interaction and communication are given a variety of diagnoses, including autistic disorder and Asperger's syndrome. The latter is usually reserved for those with stronger language skills.

While some patients prefer the label of Asperger's, perceiving it to carry less stigma, the Autistic Self Advocacy Network backs the working group's proposal. "The right thing is to look at this as a spectrum," argues ASAN's vice-president Scott Robertson, who himself has an Asperger's diagnosis.

At present, different doctors approach patients on this spectrum in different ways. "An individual can see three different clinicians and get three different diagnoses," says Robertson. This diagnostic uncertainty can be a problem in some US states, where provisions such as helpers for children at school may only be given to those with the core diagnosis of autistic disorder.

Paraphilic coercive disorder

The notion that some men are especially turned on by rape, a condition dubbed "paraphilic coercive disorder", and a shift in the definition of paedophilia to include a "hebephilic" type, referring to men who are fixated on pubescent girls, would enter the *DSM-V* under controversial proposals from its sexual disorders work group.

The validity of both conditions is hotly debated, but the inclusion of either of them in *DSM-V* would have important legal ramifications. If they are recognised as psychiatric disorders, a diagnosis could be used to keep sex offenders who have served their jail time locked away indefinitely under "civil commitment" statutes passed by 20 US states.

Temper dysregulation with dysphoria

This proposed classification would apply to some children currently diagnosed with childhood bipolar disorder, which is perhaps the most controversial psychiatric condition in the US today. Rates of diagnosis rose more than fivefold between 1994 and 2006, and concern has grown about the widespread use of mood stabilisers and antipsychotics to treat these children.

According to Gabrielle Carlson, a child psychiatrist at Stony Brook University in New York, diagnosis of juvenile bipolar disorder has expanded as a knock-on from previous diagnostic shifts, including a narrowing of conduct disorder to focus on children who will go on to become adults with antisocial personality disorder. At the same time, attention-deficit hyperactivity disorder (ADHD) has been "gentrified" to include children with milder problems, which makes it less helpful for dealing with more seriously disturbed children.

This has left psychiatrists looking for a label for children who swing between severe outbursts of aggression and periods of irritability, anger and sadness, and bipolar disorder has become a popular choice. "The diagnosis of juvenile bipolar disorder is being given, we believe, too frequently," says David Shaffer of Columbia University in New York, who chairs the *DSM-V* work group on ADHD and disruptive behaviour disorders.

"Temper dysregulation with dysphoria" is the work group's proposed solution. Children with this diagnosis are still likely to be given drugs, probably a stimulant such as Ritalin, plus an antipsychotic – possibly as a temporary measure, rather than as a long-term prescription.

http://www.newscientist.com/article/dn18508-psychiatrys-draft-new-bible-goes-online.html

Our world may be a giant hologram

- 15 January 2009 by **Marcus Chown**

Magazine issue 2691.

Has GEO600's laser probed the fundamental fuzziness of space-time? (Image: Wolfgang Filser / Max Planck Society)

DRIVING through the countryside south of Hanover, it would be easy to miss the GEO600 experiment. From the outside, it doesn't look much: in the corner of a field stands an assortment of boxy temporary buildings, from which two long trenches emerge, at a right angle to each other, covered with corrugated iron. Underneath the metal sheets, however, lies a detector that stretches for 600 metres.

For the past seven years, this German set-up has been looking for gravitational waves - ripples in space-time thrown off by super-dense astronomical objects such as neutron stars and black holes. GEO600 has not detected any gravitational waves so far, but it might inadvertently have made the most important discovery in physics for half a century.

For many months, the GEO600 team-members had been scratching their heads over inexplicable noise that is plaguing their giant detector. Then, out of the blue, a researcher approached them with an explanation. In fact, he had even predicted the noise before he knew they were detecting it. According to Craig Hogan, a physicist at the Fermilab particle physics lab in Batavia, Illinois, GEO600 has stumbled upon the fundamental limit of space-time - the point where space-time stops behaving like the smooth continuum Einstein described and instead dissolves into "grains", just as a newspaper photograph dissolves into dots as you zoom in. "It looks like GEO600 is being buffeted by the microscopic quantum convulsions of space-time," says Hogan.

If this doesn't blow your socks off, then Hogan, who has just been appointed director of Fermilab's Center for Particle Astrophysics, has an even bigger shock in store: "If the GEO600 result is what I suspect it is, then we are all living in a giant cosmic hologram."

The idea that we live in a hologram probably sounds absurd, but it is a natural extension of our best understanding of black holes, and something with a pretty firm theoretical footing. It has also been surprisingly helpful for physicists wrestling with theories of how the universe works at its most fundamental level.

The holograms you find on credit cards and banknotes are etched on two-dimensional plastic films. When light bounces off them, it recreates the appearance of a 3D image. In the 1990s physicists Leonard Susskind and Nobel prizewinner Gerard 't Hooft suggested that the same principle might apply to the universe as a whole. Our everyday experience might itself be a holographic projection of physical processes that take place on a distant, 2D surface.

The "holographic principle" challenges our sensibilities. It seems hard to believe that you woke up, brushed your teeth and are reading this article because of something happening on the boundary of the universe. No one knows what it would mean for us if we really do live in a hologram, yet theorists have good reasons to believe that many aspects of the holographic principle are true.

Susskind and 't Hooft's remarkable idea was motivated by ground-breaking work on black holes by Jacob Bekenstein of the Hebrew University of Jerusalem in Israel and Stephen Hawking at the University of Cambridge. In the mid-1970s, Hawking showed that black holes are in fact not entirely "black" but instead slowly emit radiation, which causes them to evaporate and eventually disappear. This poses a puzzle, because Hawking radiation does not convey any information about the interior of a black hole. When the black hole has gone, all the information about the star that collapsed to form the black hole has vanished, which contradicts the widely affirmed principle that information cannot be destroyed. This is known as the black hole information paradox.

Bekenstein's work provided an important clue in resolving the paradox. He discovered that a black hole's entropy - which is synonymous with its information content - is proportional to the surface area of its event horizon. This is the theoretical surface that cloaks the black hole and marks the point of no return for infalling matter or light. Theorists have since shown that microscopic quantum ripples at the event horizon can encode the information inside the black hole, so there is no mysterious information loss as the black hole evaporates.

Crucially, this provides a deep physical insight: the 3D information about a precursor star can be completely encoded in the 2D horizon of the subsequent black hole - not unlike the 3D image of an object being encoded in a 2D hologram. Susskind and 't Hooft extended the insight to the universe as a whole on the basis that the cosmos has a horizon too - the boundary from beyond which light has not had time to reach us in the 13.7-billion-year lifespan of the universe. What's more, work by several string theorists, most notably Juan Maldacena at the Institute for Advanced Study in Princeton, has confirmed that the idea is on the right track. He showed that the physics inside a hypothetical universe with five dimensions and shaped like a Pringle is the same as the physics taking place on the four-dimensional boundary.

According to Hogan, the holographic principle radically changes our picture of space-time. Theoretical physicists have long believed that quantum effects will cause space-time to convulse wildly on the tiniest scales. At this magnification, the fabric of space-time becomes grainy and is ultimately made of tiny units rather like pixels, but a hundred billion billion times smaller than a proton. This distance is known as the Planck length, a mere 10^{-35} metres. The Planck length is far beyond the reach of any conceivable experiment, so nobody dared dream that the graininess of space-time might be discernable.

That is, not until Hogan realised that the holographic principle changes everything. If space-time is a grainy hologram, then you can think of the universe as a sphere whose outer surface is papered in Planck

length-sized squares, each containing one bit of information. The holographic principle says that the amount of information papering the outside must match the number of bits contained inside the volume of the universe.

Since the volume of the spherical universe is much bigger than its outer surface, how could this be true? Hogan realised that in order to have the same number of bits inside the universe as on the boundary, the world inside must be made up of grains bigger than the Planck length. "Or, to put it another way, a holographic universe is blurry," says Hogan.

This is good news for anyone trying to probe the smallest unit of space-time. "Contrary to all expectations, it brings its microscopic quantum structure within reach of current experiments," says Hogan. So while the Planck length is too small for experiments to detect, the holographic "projection" of that graininess could be much, much larger, at around 10^{-16} metres. "If you lived inside a hologram, you could tell by measuring the blurring," he says.

When Hogan first realised this, he wondered if any experiment might be able to detect the holographic blurriness of space-time. That's where GEO600 comes in.

Gravitational wave detectors like GEO600 are essentially fantastically sensitive rulers. The idea is that if a gravitational wave passes through GEO600, it will alternately stretch space in one direction and squeeze it in another. To measure this, the GEO600 team fires a single laser through a half-silvered mirror called a beam splitter. This divides the light into two beams, which pass down the instrument's 600-metre perpendicular arms and bounce back again. The returning light beams merge together at the beam splitter and create an interference pattern of light and dark regions where the light waves either cancel out or reinforce each other. Any shift in the position of those regions tells you that the relative lengths of the arms has changed.

"The key thing is that such experiments are sensitive to changes in the length of the rulers that are far smaller than the diameter of a proton," says Hogan.

So would they be able to detect a holographic projection of grainy space-time? Of the five gravitational wave detectors around the world, Hogan realised that the Anglo-German GEO600 experiment ought to be the most sensitive to what he had in mind. He predicted that if the experiment's beam splitter is buffeted by the quantum convulsions of space-time, this will show up in its measurements (*Physical Review D*, vol 77, p 104031). "This random jitter would cause noise in the laser light signal," says Hogan.

In June he sent his prediction to the GEO600 team. "Incredibly, I discovered that the experiment was picking up unexpected noise," says Hogan. GEO600's principal investigator Karsten Danzmann of the Max Planck Institute for Gravitational Physics in Potsdam, Germany, and also the University of Hanover, admits that the excess noise, with frequencies of between 300 and 1500 hertz, had been bothering the team for a long time. He replied to Hogan and sent him a plot of the noise. "It looked exactly the same as my prediction," says Hogan. "It was as if the beam splitter had an extra sideways jitter."

Incredibly, the experiment was picking up unexpected noise - as if quantum convulsions were causing an extra sideways jitter

No one - including Hogan - is yet claiming that GEO600 has found evidence that we live in a holographic universe. It is far too soon to say. "There could still be a mundane source of the noise," Hogan admits.

Gravitational-wave detectors are extremely sensitive, so those who operate them have to work harder than most to rule out noise. They have to take into account passing clouds, distant traffic, seismological rumbles and many, many other sources that could mask a real signal. "The daily business of improving the sensitivity of these experiments always throws up some excess noise," says Danzmann. "We work to identify its cause, get rid of it and tackle the next source of excess noise." At present there are no clear

candidate sources for the noise GEO600 is experiencing. "In this respect I would consider the present situation unpleasant, but not really worrying."

For a while, the GEO600 team thought the noise Hogan was interested in was caused by fluctuations in temperature across the beam splitter. However, the team worked out that this could account for only one-third of the noise at most.

Danzmann says several planned upgrades should improve the sensitivity of GEO600 and eliminate some possible experimental sources of excess noise. "If the noise remains where it is now after these measures, then we have to think again," he says.

If GEO600 really has discovered holographic noise from quantum convulsions of space-time, then it presents a double-edged sword for gravitational wave researchers. One on hand, the noise will handicap their attempts to detect gravitational waves. On the other, it could represent an even more fundamental discovery.

Such a situation would not be unprecedented in physics. Giant detectors built to look for a hypothetical form of radioactivity in which protons decay never found such a thing. Instead, they discovered that neutrinos can change from one type into another - arguably more important because it could tell us how the universe came to be filled with matter and not antimatter (*New Scientist*, 12 April 2008, p 26).

It would be ironic if an instrument built to detect something as vast as astrophysical sources of gravitational waves inadvertently detected the minuscule graininess of space-time. "Speaking as a fundamental physicist, I see discovering holographic noise as far more interesting," says Hogan.

Small price to pay

Despite the fact that if Hogan is right, and holographic noise will spoil GEO600's ability to detect gravitational waves, Danzmann is upbeat. "Even if it limits GEO600's sensitivity in some frequency range, it would be a price we would be happy to pay in return for the first detection of the graininess of space-time." he says. "You bet we would be pleased. It would be one of the most remarkable discoveries in a long time."

However Danzmann is cautious about Hogan's proposal and believes more theoretical work needs to be done. "It's intriguing," he says. "But it's not really a theory yet, more just an idea." Like many others, Danzmann agrees it is too early to make any definitive claims. "Let's wait and see," he says. "We think it's at least a year too early to get excited."

The longer the puzzle remains, however, the stronger the motivation becomes to build a dedicated instrument to probe holographic noise. John Cramer of the University of Washington in Seattle agrees. It was a "lucky accident" that Hogan's predictions could be connected to the GEO600 experiment, he says. "It seems clear that much better experimental investigations could be mounted if they were focused specifically on the measurement and characterisation of holographic noise and related phenomena."

One possibility, according to Hogan, would be to use a device called an atom interferometer. These operate using the same principle as laser-based detectors but use beams made of ultracold atoms rather than laser light. Because atoms can behave as waves with a much smaller wavelength than light, atom interferometers are significantly smaller and therefore cheaper to build than their gravitational-wave-detector counterparts.

So what would it mean it if holographic noise has been found? Cramer likens it to the discovery of unexpected noise by an antenna at Bell Labs in New Jersey in 1964. That noise turned out to be the cosmic microwave background, the afterglow of the big bang fireball. "Not only did it earn Arno Penzias

and Robert Wilson a Nobel prize, but it confirmed the big bang and opened up a whole field of cosmology," says Cramer.

Hogan is more specific. "Forget *Quantum of Solace*, we would have directly observed the quantum of time," says Hogan. "It's the smallest possible interval of time - the Planck length divided by the speed of light."

More importantly, confirming the holographic principle would be a big help to researchers trying to unite quantum mechanics and Einstein's theory of gravity. Today the most popular approach to quantum gravity is string theory, which researchers hope could describe happenings in the universe at the most fundamental level. But it is not the only show in town. "Holographic space-time is used in certain approaches to quantising gravity that have a strong connection to string theory," says Cramer. "Consequently, some quantum gravity theories might be falsified and others reinforced."

Hogan agrees that if the holographic principle is confirmed, it rules out all approaches to quantum gravity that do not incorporate the holographic principle. Conversely, it would be a boost for those that do - including some derived from string theory and something called matrix theory. "Ultimately, we may have our first indication of how space-time emerges out of quantum theory." As serendipitous discoveries go, it's hard to get more ground-breaking than that.

Marcus Chown is the author of Quantum Theory Cannot Hurt You (Faber, 2008)

http://www.newscientist.com/article/mg20126911.300-our-world-may-be-a-giant-hologram.html

Neurons for peace: Take the pledge, brain scientists

- 08 February 2010 by **Curtis Bell**

Magazine issue 2746.

Neuroscience has a potential dark side (Image : Andrzej Krauze)

NEUROSCIENTISTS can take pride in the many contributions that their work can make to enhancing human life. These include improved treatment of illness, better education, creation of sophisticated information-processing machines and new insights into ancient human mysteries such as the nature of the mind and the self.

But there is also a dark side to neuroscience. Like any body of knowledge, it can be used for good or ill. Yet neuroscientists often seem unaware of the potential of their field to threaten or damage human life.

Aggressive wars and coercive interrogation methods such as torture are two particularly egregious ways in which human life is damaged or threatened. Not only are both immoral, they are also illegal under national and international laws. At the Nuremberg trials following the defeat of Nazi Germany, aggressive war was judged to be not only an international crime, but the supreme international crime. Prevention of such wars was a major reason for the founding of the United Nations.

Neuroscience can be of service to both aggressive war and to coercive interrogation methods. Potential contributions to aggressive war include pharmaceutical agents that enhance the effectiveness of one nation's soldiers or damage the effectiveness of their enemy's. In addition, war is becoming more and more dependent on robots such as the MQ-9 Reaper unmanned aerial vehicles now being used in Afghanistan and elsewhere. Autonomous robots that can move, perceive, decide and kill on their own are in the offing, as political scientist and military commentator Peter W. Singer describes in his book *Wired for War*. Neuroscientific work on motor control, perception, and cognition can be readily applied to the construction of such robots.

Neuroscience can be of service both to aggressive war and to coercive interrogation methods

Potential neuroscience contributions to torture are also clear. These include the creation of drugs that cause extreme pain, anxiety or unwarranted trust, as well as manipulations such as focused brain stimulation or inactivation.

A pledge is being circulated among neuroscientists around the world with the aim of creating greater awareness of the potential dark side of neuroscience. Those signing the pledge commit to two things.

First, to make themselves aware of possible applications that would violate international law or human rights, and second, to act in accordance with national and international law by refusing to knowingly participate in the application of neuroscience to such violations. Thus signers of the pledge are committing to acting responsibly, morally and in obedience to the law.

Once signatures have been gathered, neuroscience organisations, such as the Federation of European Neuroscience Societies and the Society for Neuroscience, will be asked to amend their ethics statements to forbid knowing participation in such applications.

Similar pledges and petitions have been signed by scientists from other disciplines. The majority of members of the American Psychological Association have signed a petition declaring that "psychologists may not work in settings where persons are held outside of, or in violation of, either International Law (e.g. the UN Convention Against Torture and the Geneva conventions) or the US Constitution". The governing bodies of the American Medical Association and the American Psychiatric Association have also condemned participation in torture.

Many anthropologists have signed a pledge issued by the Network of Concerned Anthropologists in relation to the US's "war on terror", declaring that "anthropologists should refrain from directly assisting the US military in combat, be it through torture, interrogation or tactical advice". The American Association of Anthropology's executive board has issued a statement in accord with the pledge.

Unlike psychologists, physicians or anthropologists, neuroscientists are unlikely to provide direct assistance to combat forces fighting an aggressive war or participate directly in torture. They could provide tools for such purposes, however, and thus act as accessories to the crime.

Opinions may vary as to whether a given application constitutes torture and whether a given war is an aggressive war. Here one can be guided by international law as embodied in the UN charter, the Geneva conventions and the Convention Against Torture. Aggressive war, for example, is defined as a war that is not in self-defence, with the corollary that all peaceful means of resolving a conflict must be pursued before a war is begun.

Opinions will be especially varied concerning aggressive war, but the pledge simply commits signers, once convinced that a war is aggressive, to refuse to provide the government conducting the war with additional tools.

Signing this pledge will not stop aggressive wars or human rights violations, or even the use of neuroscience for these purposes. But by signing, neuroscientists will help make such applications less acceptable.

The pledge gives neuroscience the opportunity to join with other professions in moving away from militarism and violence toward a culture of peace and respect for human life. Professionals and their organisations have a special responsibility in this regard, because they are members of a respected elite with knowledge and influence.

Our goal as neuroscientists and human beings should be to create a culture that encourages applications that enhance human life while discouraging those that damage it. If you are a neuroscientist and you agree, sign the pledge.

Curtis Bell is a neuroscientist and Senior Scientist Emeritus at Oregon Health and Science University in Portland. The pledge can be signed at tinyurl.com/neuroscientistpledge

http://www.newscientist.com/article/mg20527465.900-neurons-for-peace-take-the-pledge-brain-scientists.html

Damaged brains escape the material world

- 15:48 11 February 2010 by **Ewen Callaway**

Increased feelings of transcendence can follow brain damage, a study of people with brain cancer suggests.

As feelings of transcending the physical world can be part of some religious experiences and other forms of spirituality, the finding may help explain why some people seem more prone to such experiences than others.

The brain region in question, the posterior parietal cortex, is involved in maintaining a sense of self, for example by helping you keep track of your body parts. It has also been linked to prayer and meditation

To further probe its role, Cosimo Urgesi, a neuroscientist at the University of Udine in Italy, turned to 88 people who were being treated for brain cancer.

Brain surgery

These volunteers suffered from two kinds of cancer: gliomas, which affect the brain cells that surround neurons, and meningiomas, which affect the membrane that wraps the brain itself.

Doctors removed neurons from the 48 glioma patients to stem the spread of their tumours, whereas the people with meningiomas had tumour cells removed, but no neurons.

Both before and not long after the patients received this surgery Urgesi's team gave them a battery of personality tests. In particular, the researchers were interested in a personality trait known as self-transcendence.

People score highly for this trait if they answer "yes" to questions such as: "I often feel so connected to the people around me that I feel like there is no separation"; "I feel so connected to nature that everything feels like one single organism"; and "I got lost in the moment and detached from time". The same people also tend to believe in miracles, extrasensory perception and other non-material phenomena.

Personality change

Urgesi's team found that the 24 people with gliomas in the posterior parietal cortex tended to score higher on the self-transcendence test after surgery than they had before. By contrast, the scores of people with gliomas in the anterior region of the cortex, and of people with meningiomas, did not change after their surgery.

This suggests that it is the removal of neurons from the posterior parietal cortex which is responsible for the personality change, and not simply experiencing a serious illness or undergoing brain surgery, Urgesi says. He suggests that the removal reduces activity in this brain region and that this may increase feelings of transcendence.

Moreover, Urgesi noticed differences in the way the patients dealt with their illnesses. Those who had lost posterior parietal tissue tended to be less troubled by their cancers and their own mortality. Meanwhile those who had had their anterior portion removed tended to react more bitterly, Urgesi says. "They could not accept it."

Urgesi speculates that naturally low activity in parietal regions in people without either brain damage or cancer could predispose them to self-transcendent feelings, and perhaps even to religions that emphasise such experiences such as Buddhism.

Out of body

"The idea of spirituality equalling the self-transcendence scale is perhaps a bit controversial," says Uffe Schjødt, a cognitive neuroscientist at the Aarhus University, Denmark.

But he adds that the study "does fit with previous work in the neuroscience of religion". For example, studies in Buddhist monks, Catholic nuns and people experienced in meditation have shown that the posterior parietal cortex plays a role in prayer and meditation.

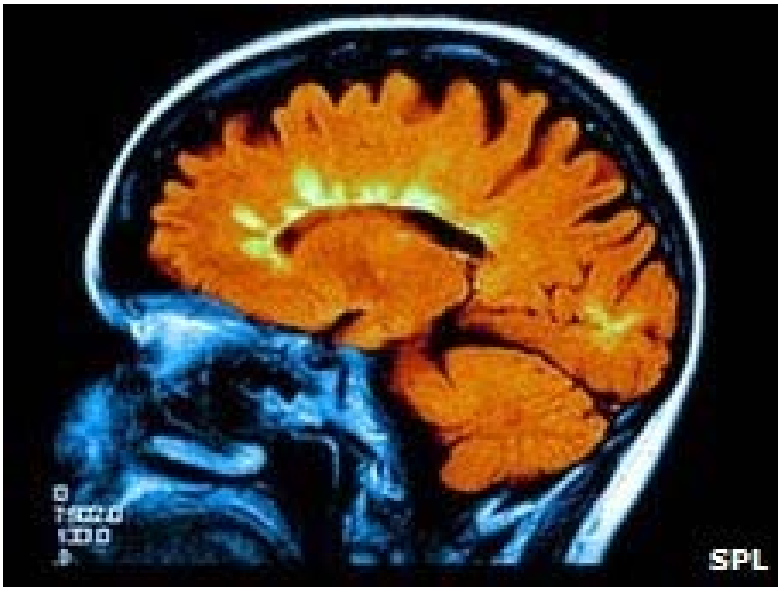
Urgesi also notes that electrically stimulating the temporoparietal junction – an area near the posterior parietal cortex – is known to induce out-of-body experiences , which also involve a breakdown in someone's representation of their physical self and their environment.

Journal reference: *Neuron*, DOI: 10.1016/j.neuron.2010.01.026

http://www.newscientist.com/article/dn18513-damaged-brains-escape-the-material-world.html

Brain blood vessels clue to MS

More than 55% of multiple sclerosis patients have been found to have constricted blood vessels in their brains, a US study says.



The preliminary results are from the first 500 patients enrolled in a trial at the University of Buffalo.

The abnormality was found in 56.4% of MS patients and also in 22.4% of healthy controls.

The MS Society said it was intriguing but not proof that this caused MS - as one leading expert claims.

Testing theory

The New York researchers were testing a theory from Italian researcher, Dr Paolo Zamboni who claims that 90% of MS is caused by narrowed veins.

" **These results are intriguing but it is important to remember that although people with MS may show evidence of chronic cerebrospinal venous insufficiency in screening studies, there's no proof as yet that this phenomenon is a cause of MS, nor that treating it would have an effect on MS** "
Dr Doug Brown, MS Society

He says the restricted vessels prevent the blood from draining fast enough and injure the brain by causing a build up of iron which leads to MS.

He has already widened the blockages in a handful of patients including his wife.

MS is a long-term inflammatory condition of the central nervous system which affects the transfer of messages from the nervous system to the rest of the body.

The Buffalo team used Doppler ultrasound to scan the patients in different body postures to view the direction of venous blood flow.

The 500 MS patients, both adults and children, also underwent MRI scans of the brain to measure iron deposits in surrounding areas of the brain.

The full results will be presented at an American neurology conference in April.

There were 161 healthy controls.

'Cautious optimism'

Robert Zivadinov who led the study at the University of Buffalo, said he was "cautiously optimistic and excited" about the preliminary data.

"They show that narrowing of the extracranial veins, at the very least, is an important association in multiple sclerosis.

"We will know more when the MRI and other data collected in this study are available."

Dr Doug Brown, Biomedical Research Manager at the MS Society, said: "These results are intriguing but it is important to remember that although people with MS may show evidence of chronic cerebrospinal venous insufficiency in screening studies, there's no proof as yet that this phenomenon is a cause of MS, nor that treating it would have an effect on MS.

"The next step is to determine what this actually means for MS and an investigation into whether there's any potential therapeutic benefit from treatment will be pivotal for this novel theory."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8509106.stm

Published: 2010/02/10 17:17:14 GMT

Sweet tooth 'hints at depression'

While most children like sweets, those with an extra-sweet tooth may be depressed or at higher risk of future alcohol problems, researchers say.

The US team report in the journal Addiction that certain children are especially drawn to very sweet tastes.

These were children who had a close relative with an alcohol problem or who themselves had symptoms of depression.

But it is unclear if the preference for the very sweet is down to genuine chemical differences or upbringing.

The researchers say sweet taste and alcohol trigger many of the same reward circuits in the brain.

" **It may be that even higher levels of sweetness are needed to make depressed children feel better** "
Lead researcher Julie Mennella

Lead author Julie Mennella said: "We know that sweet taste is rewarding to all kids and makes them feel good.

"In addition, certain groups of children may be especially attracted to the intense sweetness due to their underlying biology."

Experts say alcoholics tend to have a sweet tooth.

But the link is less clear in children. Other US researchers have shown that a preference for the sweetest drinks was found in the ones undergoing growth spurts.

In the latest study, the scientists at the Monell Chemical Senses Center asked 300 children aged five to 12, of whom half had a family member with alcohol dependency, to taste five sweet water drinks containing different amounts of sugar.

The children were asked to say which tasted the best and were also asked questions to check for depressive symptoms.

A quarter had symptoms that the researchers believed suggested they might be depressed.

Sweet tooth

Liking for intense sweetness was greatest in the 37 children who had both a family history of alcoholism and reported depressive symptoms.

“ **The taste difference may be explained by differences like parental control over sweet consumption** ”

Taste expert Professor Tim Jacob

These children preferred the drink containing the most sugar - 24% sucrose, which is equivalent to about 14 teaspoons of sugar in a cup of water and more than twice the level of sweetness in a typical cola.

This was a third more intense than the sweetness level preferred by the other children.

The researchers then decided to test whether the children's taste difference had any impact on their reaction to pain or discomfort - past studies have suggested sweets may help act as analgesics as well as mood lifters.

They found non-depressed children were able to tolerate keeping their hands in very cold water for longer if they had a sugar hit.

However, the extra sugar did nothing to the depressed children's pain threshold.

Cardiff University's Professor Tim Jacob, an expert in smell and taste, said the findings were interesting, but that it was hard to make firm conclusions or generalisations from one study alone.

He said the findings could be down to brain chemistry, but might also be explained by behaviour and upbringing.

"While it is true that sweet things activate reward circuits in the brain, the problem is that sweets and sugar are addictive, because the activation of these reward circuits causes opioid release, and with time more is needed to achieve the same effect.

"But the taste difference may be explained by differences like parental control over sweet consumption."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8506758.stm

Published: 2010/02/10 00:02:55 GMT

'Giant' Fossils Are Revolutionizing Current Thinking

Large-sized gastropods found in marine sediments in Utah dating from only ~1 million years after the P-T mass extinction. The scale bar represents 1 cm. (Credit: Copyright A. Brayard/J. Thomas)

ScienceDaily (Feb. 11, 2010) — Large-sized gastropods (1) (up to 7 cm) dating from only 1 million years after the greatest mass extinction of all time, the Permian-Triassic extinction (2), have been discovered by an international team including a French researcher from the Laboratoire Biogéosciences (CNRS/Université de Bourgogne), working with German, American and Swiss colleagues. These specimens call into question the existence of a "Lilliput effect," the reduction in the size of organisms inhabiting postcrisis biota, normally spanning several million years.

The team's results, published in the February 2010 issue of the journal *Geology*, have drastically changed paleontologists' current thinking regarding evolutionary dynamics and the way the biosphere functions in the aftermath of a mass extinction event.

The history of life on Earth has been punctuated by numerous mass extinctions, brief periods during which biodiversity is considerably reduced, followed by phases of re-conquest of the biosphere, corresponding to the diversification of those species that survived. Over the last 540 million years, around twenty mass extinctions, of greater or lesser intensity, have succeeded one another. The most devastating of these, the Permian-Triassic (P-T) mass extinction, which decimated more than 90% of the marine species existing at the time, occurred 252.6 million years ago with a violence that is still unequaled today.

In the aftermath of such events, environmental conditions are severely disrupted: the oceans become less oxygenated, water becomes poisonous, there is increased competition, collapse of food chains, etc. Until now, it has generally been accepted that certain marine organisms, such as gastropods or bivalves, were affected by a drastic reduction in size in response to major disruptions of this nature, both during and after

the event. It took several million years for such organisms to return to sizes comparable to those that existed prior to the crisis. This is what scientists call the "Lilliput effect," in reference to the travels of Gulliver (3) who was shipwrecked on the island of the same name, inhabited by very small Lilliputians.An international team of French, German, American and Swiss paleontologists has recently discovered large gastropod fossils dating from only 1 million years after the P-T mass extinction. The researchers have spent several years studying the re-conquest phase that followed the P-T crisis. By focusing their efforts on fossil-bearing outcrops in Utah dating from the Early Triassic, which have not yet been studied in detail, they have uncovered some outstanding specimens of gastropods, up to 7 cm, which can be termed as "giants" in comparison to those generally found, normally no bigger than 1 cm.

Complementary studies of these new gastropod fauna also indicate that they are not any smaller than older or present-day fauna. This discovery therefore refutes the existence of a Lilliput effect on gastropods during the major part of the Early Triassic or, at the very least, suggests that its importance has been overestimated. Quite surprisingly, the presence of these large gastropods also coincides with an explosive re-conquest of the ocean by organisms such as ammonites (4, 5). Taken together, these events therefore suggest that restructuring of marine ecosystems was already well underway only one million years after the P-T crisis, a very short time after a mass extinction of such magnitude.

The researchers plan to continue to study the fossils discovered in this locality in Utah while searching for other species and groups, such as bivalves, to confirm this new data. However, these findings already suggest that paleontologists are going to have to re-think the immediate and long term impact of mass extinctions on species.

Notes:

(1) The gastropods concerned by this study are mollusks that lived on the sea bed and are related, for example, to present-day land snails.

(2) The Permian-Triassic mass extinction, named after the two geological periods that encompass it, namely the Permian (299 -- 252.6 Ma) and the Triassic (252.6 -- 201.6 Ma), is the greatest mass extinction ever documented. It marks the end of the Primary (or Paleozoic) era and the beginning of the Secondary (or Mesozoic) era.

(3) *Gulliver's Travels*, written by Jonathan Swift in the 18th century.

(4) Ammonoids, related to present-day nautilus, cuttlefish and squid, are free-swimming cephalopod mollusks with external shells. They disappeared from the world's oceans at the same time as the dinosaurs, 65 million years ago, after having been a major part of the marine fauna for nearly 400 million years.

(5) See also Brayard et al. 2009. *Science* 235: 1118-1121.

Story Source:

Adapted from materials provided by CNRS.

Journal Reference:

1. Brayard A., Nützel A., Stephen D.A., Bylund K.G., Jenks J. and Bucher H. **Gastropod evidence against the Early Triassic Lilliput effect**. *Geology*, 2010; 38 (2): 147 DOI: 10.1130/G30553.1

http://www.sciencedaily.com/releases/2010/02/100210171413.htm

Benefits Outweigh Risks Associated With Newborn Screening for Disorder

Newborn screening for a metabolic disorder could lead to false positives -- adding stress to parents, costing money and possibly subjecting a baby to unnecessary follow-up treatment and dietary restrictions. But the benefits of diagnosing these children early and preventing the risk of mental retardation, disability or death outweigh the costs of a false positive, researchers say. (Credit: Image courtesy of University of Michigan Health System)

ScienceDaily (Feb. 11, 2010) — Newborn screening for a metabolic disorder could lead to false positives -- adding stress to parents, costing money and possibly subjecting a baby to unnecessary follow-up treatment and dietary restrictions.

But the benefits of diagnosing these children early and preventing the risk of mental retardation, disability or death outweigh the costs of a false positive, according to new U-M research published in the February issue of the journal *Pediatrics*.

"Published studies of expanded newborn screening in a U.S. setting have resulted in favorable cost-effective ratios for screening for this illness but did not include primary data for quality of life effects for a false positive screen," says Lisa Prosser, Ph.D., Research Associate Professor in the Division of General Pediatrics at the University of Michigan Health System and the study's lead author. "Our results show that newborn screening remains cost-effective after accounting for the measured loss in quality of life associated with a false positive screen."

The metabolic disorder commonly referred to as MCADD -- or medium chain acyl-CoA dehydrogenase deficiency -- shows up in one of 15,000 newborns.

When the MCAD enzyme is not working or missing, the body cannot use certain types of fat for energy. This can lead to low blood sugar, or hypoglycemia, and the build-up of harmful substances in the blood. While MCADD patients are usually healthy, repeated episodes of metabolic crisis can cause permanent brain damage. This may result in learning problems and mental retardation.

Researchers used a computer model that took into account costs of screening, including the initial screen test, parent time and medical costs of follow-up testing, treatment and the quality of life implications of having dietary restrictions.

They found that screening requires substantial investment of resources but in exchange for important health benefits. The costs of newborn screening for the illness amounted to $21,000 for every quality-adjusted life year that was gained. A quality-adjusted life year can be thought of as representing a year in perfect health.

"The cost-effectiveness of newborn screening for MCADD is comparable to cost-effectiveness for other childhood interventions, such as vaccinations," Prosser says.

As the number of screened conditions increases, the number of false positives and associated costs also increase, along with the possible identification and treatment of children who may not have experienced related medical problems in the absence of screening, she adds.

"Newborn screening for MCADD remains cost-effective even when the loss in quality of life associated with false positives or dietary treatments are taken into account," Prosser concludes.

In addition to Lisa A. Prosser, other authors were Chung Yin Kong, Ph.D., University of Michigan; Donna Rusinak, B.A., Harvard Medical School; and Susan L. Waisbren, Ph.D., Children's Hospital Boston

Funding for this study was provided by the National Human Genome Research Institute, Division of Ethical, Legal and Social Implications (2R01HG002085-04).

Story Source:

Adapted from materials provided by University of Michigan Health System. Original article written by Margarita Bauza-Wagerson.

http://www.sciencedaily.com/releases/2010/02/100201145515.htm

Study Reveals Need to Evaluate and Regulate 'Electronic Cigarettes'

ScienceDaily (Feb. 11, 2010) — Electronic cigarettes should be evaluated, regulated, labeled and packaged in a manner consistent with cartridge content and product effect -- even if that effect is a total failure to deliver nicotine as demonstrated in a study supported by the National Cancer Institute and led by a Virginia Commonwealth University researcher.

The research was published in the Online First issue of the journal Tobacco Control. The article will appear in the February print issue of the journal.

Electronic cigarettes consist of a battery, heater and cartridge containing a solution of nicotine, propylene glycol and other chemicals and have been marketed to deliver nicotine without tobacco toxicants. Despite no published data concerning safety or efficacy, these products are sold in shopping malls and online. Further, "electronic cigarettes" currently are unregulated in the U.S., unlike other products intended to deliver nicotine to smokers such as lozenges, gum and patches.

"Consumers have a right to expect that products marketed to deliver a drug will work safely and as promised. Our findings demonstrate that the 'electronic cigarettes' that we tested do not deliver the drug they are supposed to deliver. It's not just that they delivered less nicotine than a cigarette. Rather, they delivered no measurable nicotine at all. In terms of nicotine delivery, these products were as effective as puffing from an unlit cigarette," said principal investigator Thomas Eissenberg, Ph.D., professor in the VCU Department of Psychology.

According to Eissenberg, these findings are important because they demonstrate why regulation of these products is essential for protecting the welfare and rights of consumers. With regulation, consumers can expect that these and similar products will be evaluated objectively and then labeled and packaged in a manner that is consistent with the drug they contain and the effects they produce, he said.

"Regulation can protect consumers from unsafe and ineffective products, but these products have somehow avoided regulation thus far. Our results suggest that consumers interested in safe and effective nicotine delivery need to be very wary of unregulated "electronic cigarettes," said Eissenberg.

In Eissenberg's study, 16 participants engaged in four different sessions -- each separated by 48 hours -- which included smoking their preferred brand of cigarettes, puffing an unlit cigarette, or using one of two different brands of "electronic cigarettes" loaded with "high" strength, which is 16 mg, nicotine cartridges. Eissenberg and his team measured the level of nicotine in the participants' blood and also their heart rate and craving for a cigarette/nicotine.

They observed that when participants used the two brands of "electronic cigarettes," there was no significant increase in nicotine levels or heart rate, and little reduction in craving. However, when participants smoked their own brand of cigarettes, substantial and significant increases in plasma nicotine and heart rate, and decreases in craving were observed.

Eissenberg, who is director of the VCU Clinical Behavioral Pharmacology Laboratory and a researcher with the VCU Institute for Drug and Alcohol Studies, has completed a series of studies demonstrating how clinical laboratory methods can be used to evaluate the toxicant exposure and other effects of novel products for tobacco users.This work was supported by a grant from the National Cancer Institute.

Story Source:

Adapted from materials provided by Virginia Commonwealth University.

http://www.sciencedaily.com/releases/2010/02/100210161734.htm

Birds, Foxes and Small Mammals Adapt Their Diets to Global Warming

Arctic fox in the Canadian Arctic. (Credit: iStockphoto/John Pitcher)

ScienceDaily (Feb. 11, 2010) — Some animals, it seems, are going on a diet, while others have expanding waistlines.

It's likely these are reactions to rapidly rising temperatures due to global climate change, speculates Prof. Yoram Yom-Tov of Tel Aviv University's Department of Zoology, who has been measuring the evolving body sizes of birds and animals in areas where climate change is most extreme.

Changes are happening primarily in higher latitudes, where Prof. Yom-Tov has identified a pattern of birds getting smaller and mammals getting bigger, according to most of the species he's examined. The change, he hypothesizes, is likely a strategy for survival. Prof. Yom-Tov, who has spent decades measuring and monitoring the body sizes of mammals and small birds, says that these changes have been happening more rapidly.

His most recent paper on the topic, focused on the declining body sizes of arctic foxes in Iceland, appeared in *Global Change Biology*.

Radical changes in body size

Animal populations in a wide variety of geographical areas -- birds in the UK, small mammals in the arctic, and most recently foxes, lynx and otters in cold Scandinavian regions -- are adapting to a shift in rising temperatures. Where temperature changes are most radical, such as those at higher latitudes, Prof. Yom-Tov has measured the most radical changes of these animals' body size over time.

"This change can be seen as an early indicator of climate change," says Prof. Yom-Tov. "There is a steady increase of temperatures at higher latitudes, and this effect -- whether it's man-made or natural -- is having an impact on the animals living in these zones."

In his most recent paper, Prof. Yom-Tov and his Tel Aviv University colleague Prof. Eli Geffen report that arctic foxes are being influenced by changing water currents in the oceans. These changes, likely a result of climate change, affects the foxes' food supplies. Hydrologists are confounded as to why the shifts in currents are happening, but the effect in foxes is evident: their bodies are changing along with the changing currents.

Scientists are finding changes in animals' bodies across the whole animal kingdom. "Climate change is affecting migration patterns and the behavior and growth of birds, mammals, insects, flowers -- you name it," says Prof. Yom-Tov. "The global warming phenomenon is a fact." What we do with this information may change our world.

Adapting to survive

Whether or not human beings are primarily responsible for climate change, Prof. Yom-Tov says, science shows that plants and animals are rapidly evolving in response to these changes. Smaller bodies allow mammals, for example, to cope with warmer temperatures, since a smaller body size gives the body a proportionally increased surface area for the dissipation of heat, he says.

"These animals need to adapt themselves to changing temperatures. In some regions the changes are as large as 3 or 4 degrees centigrade," says Prof. Yom-Tov. "If they don't adapt, their numbers may decline. If they do, their numbers remain stable or even increase."

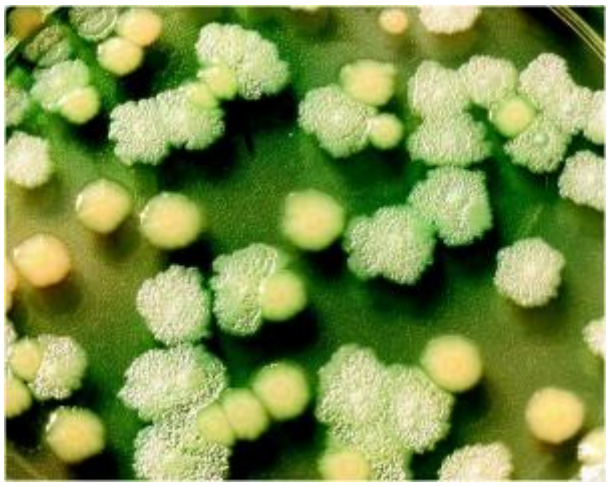
Prof. Yom-Tov's method accesses many years' worth of data, comparing bones and skulls that natural history museums and individuals have collected over decades. He measures body sizes by studying various features (cranial size, for example) and then statistically analyzes how they have evolved.

Story Source:

Adapted from materials provided by American Friends of Tel Aviv University.

http://www.sciencedaily.com/releases/2010/02/100209152235.htm

Adapting to Clogged Airways Makes Common Pathogen Resist Powerful Drugs



Normal and mutant Pseudomonas: The rounded, yellow colonies are of a normal (wild-type) Pseudomonas colony from a cystic fibrosis patient, and the flattened, pock-marked, iridescent colonies are lasR mutant Pseudomonas colonies from the same patient. Both are growing on the same nutrient agar petri dish. Mutations that enable Pseudomonas to thrive in cystic fibrosis lung secretions may also guard the bacteria against antibiotics. (Credit: Hemantha Kulasekara)

ScienceDaily (Feb. 11, 2010) — People with cystic fibrosis, an inherited disease that clogs airways with thick mucous, frequently have lung infections that defy treatment. While the life expectancy for children with cystic fibrosis has increased over the past few decades, many lives are still shortened in young adulthood by the ravages of lung infections.

These chronic infections are often caused by common, environmental microbes that mutate in ways that let them live and thrive in viscous lung secretions. The same adaptations also make the pathogens less likely to be killed off by powerful antibiotics, according to a recent study led by Dr. Lucas "Luke" Hoffman, University of Washington (UW) assistant professor of pediatrics.

Surprisingly, he added, the pathogens don't need any previous exposure to the antibiotics to resist their effects. The results were published in the latest edition of *PLoS Pathogens*.

The researchers looked at *Pseudomonas aeruginosa*, a microbe that can infect a cystic fibrosis patient early in life and then undergo various changes as it establishes a chronic lung infection. *Pseudomonas aeruginosa* with specific alterations tend to give patients a poor outcome. Some of those alterations diminish the chances of eradicating the infection with antibiotics.

It's believed that these adaptive alterations in *Pseudomonas*, all of which are caused by genetic changes, could be selected for by the environment inside a patient's airways, the researchers noted. Characteristics that facilitate microbial survival begin to emerge.

The specific airway conditions that select for these genetic changes, Hoffman said, remain unclear. "But," he added, "we have some clues from what is known about airway mucus."

From the point of view of *Pseudomonas*, the physical properties of cystic fibrosis mucus, Hoffman said, "make it a great place for the stuff people routinely breathe in to set up shop." Cystic fibrosis secretions contain a lot of nitrates and amino acids, which *Pseudomonas* can use to grow.

Inside mucus plugs oxygen levels are low. Some *Pseudomonas* strains can live in this oxygen-poor, nutrient-rich environment. Hoffman and his team found that a mutation that occurs commonly in

Pseudomonas from cystic fibrosis patients allows the pathogen to grow better in the nutrient environment in cystic fibrosis secretions. This particular mutation inactivates a gene named lasR. *Pseudomonas* with this mutation apparently undergo a metabolic shift: consuming less oxygen while utilizing nitrate more efficiently. lasR mutant bacteria also can handle oxidative stress resulting from an imbalance of damaging substances called free radicals forming faster than they can be detoxified.

One source of oxidative stress encountered by *Pseudomonas* is the antibiotic treatment that is frequently given to people who have cystic fibrosis. Antibiotics like ciprofloxacin and tobramycin kill bacteria partly by inducing the overproduction of free radicals and causing oxidative stress. Hoffman and his team found that, because these mutant microbes are resistant to oxidative stress, they were relatively resistant to these antibiotics when grown in conditions that were like cystic fibrosis mucus.

"We learned that simply by adapting to the conditions inside the airways of cystic fibrosis patients, mutated *Pseudomonas* can withstand the effects of ciprofloxacin and tobramycin," Hoffman said. They did not need any previous exposure to these antibiotics to reduce their susceptibility.

Hoffman and his team suspect that *Pseudomonas* is not the only microbe that can do this. Some of the characteristics conferred by the mutation in *Pseudomonas* are also exhibited in other microbes found in chronic lung infections, such as tuberculosis or the fungal pathogen, *Cryptococcus neoformans*, Hoffman noted. Metabolic shifts may be a way many microbes get the upper hand over their hosts -- and over antibiotics.

This report, Hoffman said, may point to new ideas for treating chronic lung infections. Luckily, colonies of *Pseudomonas* with the lasR mutation are relatively easy to identify in hospital laboratories by their distinctive iridescent sheen. Because lasR mutant *Pseudomonas* has been associated with worse outcomes in cystic fibrosis patients, indentifying *Pseudomonas* with the lasR mutation may be of prognostic value and may indicate the need for treatment with specific antibiotics like monobactams, tetracyclines, or polymyxin, whose mode of action differs from ciprofloxacin and tobramycin. Other treatment methods may be targeted at preventing adaptive changes, such as the lasR mutation, in *Pseudomonas*, the researchers said.

In addition to Hoffman, scientists on this study were Anthony Richardson, Ferric Fang, and Samuel Miller from the UW Department of Microbiology; Laura Houston and Jane Burns from the UW Department of Pediatrics; Hermantha Kulasekara and Mikkel Klausen from the UW Department of Genome Sciences; Wilm Martens-Habbena and David Stahl from the UW Department of Civil and Environmental Engineering; and Daniel Hassett from Department of Molecular Genetics, Biochemistry and Microbiology at the University of Cincinnati College of Medicine in Ohio. Fang and Miller both hold appointments in the UW Department of Medicine. Fang is also with the UW Department of Laboratory Medicine and Miller is also with UW Department of Genome Sciences.

The research was funded by grants from the Cystic Fibrosis Foundation, the National Institutes of Health, and the National Science Foundation.

Story Source:

Adapted from materials provided by University of Washington.

http://www.sciencedaily.com/releases/2010/02/100209183238.htm

Agricultural Scientists Sequence Genome of Grass That Can Be a Biofuel Model Crop

John Vogel of the U.S. Department of Agriculture (USDA) Agricultural Research Service (ARS) with the first wild grass to be sequenced, Brachypodium distachyon. (Credit: USDA)

ScienceDaily (Feb. 10, 2010) — U.S. Department of Agriculture (USDA) scientists and their colleagues at the Department of Energy (DOE) Joint Genome Institute have announced that they have completed sequencing the genome of a kind of wild grass that will enable researchers to shed light on the genetics behind hardier varieties of wheat and improved varieties of biofuel crops.

The research is published in the journal *Nature.*

"Energy security looms as one of the most important scientific challenges of this century," said Molly Jahn, USDA Acting Under Secretary for Research, Education and Economics. "This important research will help scientists develop switchgrass varieties that are more suitable for bioenergy production by identifying the genetic basis for traits such as disease resistance, drought tolerance and the composition of cells."

The grass, *Brachypodium distachyon*, can be used by plant scientists the way other researchers use lab mice to study human disease -- as a model organism that is similar to but easier to grow and study than important agricultural crops, including wheat and barley. The research also supports the USDA priority of developing new sources of bioenergy; the brachypodium genome is similar to that of the potential bioenergy crop switchgrass. But the smaller genome of brachypodium makes it easier to find genes linked to specific traits, such as stem size and disease resistance.

Brachypodium (pronounced bracky-POE-dee-umm) also is easier to grow than many grasses, takes up less laboratory space, and offers easy transformation, which means scientists can insert foreign DNA into it to study gene function and targeted approaches for crop improvement in the transformed plants, said

John Vogel, a lead author and molecular biologist with the Agricultural Research Service (ARS), USDA's chief intramural scientific research agency. Vogel works at the ARS Genomics and Gene Discovery Research Unit in Albany, Calif. ARS geneticist David Garvin at the agency's Plant Science Research Unit in St. Paul, Minn., is also a lead author on the paper.

A major stumbling block in using switchgrass or any perennial grass as a biofuel crop is the difficulty in breaking down its cell walls, an essential step in producing ethanol from cellulosic biomass. Brachypodium may hold the key to finding ways to produce plant cell walls that are easy to break down, Vogel said.

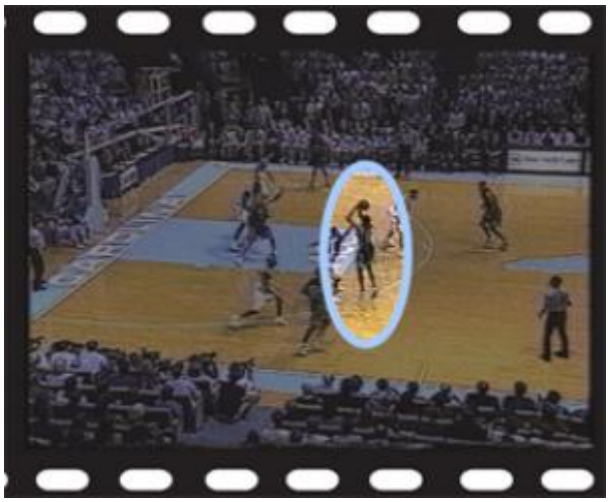
Vogel developed a method with a very high success rate for inserting genes into brachypodium. He, Garvin and their colleagues are spearheading efforts to promote brachypodium as an experimental model. They shared brachypodium seeds with more than 300 labs in 25 countries and gave scientists worldwide free access to a draft sequence of the brachypodium genome long before the work was formally published. The sequencing project was carried out through the DOE-JGI Community Sequencing Program.

Story Source:

Adapted from materials provided by USDA/Agricultural Research Service, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/02/100210131957.htm

Brain Scans Track Hoop Fans' Happy Memories



Subjects watched game video that froze just as a shot was released and had to recall if it went in or not. (Credit: Courtesy of Duke Athletics)

ScienceDaily (Feb. 10, 2010) — In a novel study that used historical tape of a thrilling overtime basketball game between Duke and the University of North Carolina at Chapel Hill, brain researchers at Duke have found that fans remember the good things their team did much better than the bad.

It's serious science, aimed at understanding the links between emotion and memory that might affect Post-Traumatic Stress Disorder and how well people recall their personal histories.

Struggling to find a way to measure a person's brain while subjecting them to powerful emotions, Duke scientists hit on the idea of using basketball fans who live and die with each three-pointer. Using game film gives researchers a way to see the brain deal with powerful, rapid-fire positive and negative emotions, without creating any ethical concerns.

"You can get much more emotional intensity with a basketball film than you could ethically otherwise," said study co-author David Rubin, the Juanita M. Kreps Professor of Psychology & Neuroscience at Duke. Similar studies, for example, might use pictures of flowers versus mutilated bodies.

Two dozen college-aged men from both Duke and UNC who had passed a basketball literacy test to determine their true fandom were shown an edited tape of the Feb. 3, 2000 game at UNC's Dean Smith Center, which Duke won 90-86 in overtime. They watched the full game three times with a few like-minded friends, and then went into an MRI machine individually to watch a series of 12-second clips leading up to a shot. Each of the 64 taped segments ends just as a player releases the shot, and the subjects had to answer whether it went in the basket or not.

Test subjects were more accurate at remembering a successful shot by their own team than a miss by their team or a successful shot by the other team. Positive emotion improved their memory and "broadened their attention," according to neuroscientist Kevin LaBar, who co-authored the study, which will appear Feb. 10 in the *Journal of Neuroscience.*

What the researchers saw in the MRI scan is multiple areas of the brain being recruited to assemble a memory. The fan's connection to the game includes an emotional component from the amygdala, a memory component from the hippocampus, and some empathy from the pre-frontal cortex as the subject feels some relation to the player or to the other fans on his side, LaBar said. Some of the sensory-motor areas light up, too, as if the subject is imagining himself as the shooter. Brain areas that control attention were more active for plays that benefitted the fan's team than for those that did not.

These brain regions function together to improve memory storage, particularly for emotionally intense plays, said LaBar, who is an associate professor of psychology & neuroscience.

Unfortunately, traumatic events can be stored in memory the same way, making them persistent and difficult to handle, said Rubin. "Brain imaging provides details we could not get with earlier technologies, such as studies of brain damage."

Ongoing studies by the same researchers are monitoring fans in real time as they watch a game to get a glimpse of what brain areas are involved in forming positive and negative memories in the first place. Rubin would also like to see how the brains of emotionally impaired and depressed people might respond differently.

A pilot study for the basketball experiment included a half-dozen women who had passed the super-fan test, but even after five or six showings of the game, their recall of the shots was too low to be useful. The researchers aren't sure why that happened, but would like to try again with women who played basketball or by using a tape of a women's basketball game to see if that makes a difference.

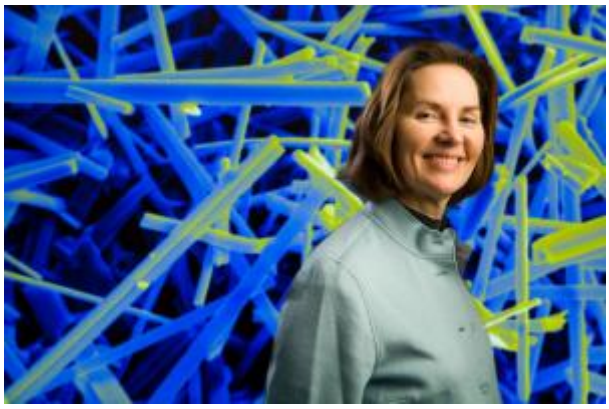
Rubin said the Duke fans and the UNC fans did equally well on the recall test, though the Duke fans tended to answer quicker and tended to be more sure of themselves. "They thought there were better, but they weren't," he said. Roberto Cabeza, a professor of psychology & neuroscience, Anne Botzung, a postdoctoral fellow, and Amanda Miles, who is now a graduate student, also participated in the research, which was supported by two grants from the National Institutes of Mental Health.

Story Source:

Adapted from materials provided by Duke University.

http://www.sciencedaily.com/releases/2010/02/100209182932.htm

Silver Nanoparticles May One Day Be Key to Devices That Keep Hearts Beating Strong and Steady



UB researcher Esther Takeuchi is tuning new battery materials at the atomic level in order to realize more powerful, longer-lasting implantable biomedical devices. (Credit: Image courtesy of University at Buffalo)

ScienceDaily (Feb. 10, 2010) — Diamonds and gold may make some hearts flutter on Valentine's Day, but in a University at Buffalo laboratory, silver nanoparticles are being designed to do just the opposite.

The nanoparticles are part of a new family of materials being created in the laboratory of SUNY Distinguished Professor and Greatbatch Professor of Advanced Power Sources Esther Takeuchi, PhD, who developed the lithium/silver vanadium oxide battery. The battery was a major factor in bringing implantable cardiac defibrillators (ICDs) into production in the late 1980s. ICDs shock the heart into a normal rhythm when it goes into fibrillation.

Twenty years later, with more than 300,000 of these units being implanted every year, the majority of them are powered by the battery system developed and improved by Takeuchi and her team. For that work she has earned more than 140 patents, believed to be more than any other woman in the United States. Last fall, she was one of four recipients honored in a White House ceremony with the National Medal of Technology and Innovation.

ICD batteries, in general, now last five to seven years. But she and her husband and co-investigator, SUNY Distinguished Teaching Professor of Chemistry Kenneth Takeuchi, PhD, and Amy Marschilok, PhD, UB research assistant professor of chemistry, are exploring even-better battery systems, by fine-tuning bimetallic materials at the atomic level.

Their research investigating feasibility for ICD use is funded by the National Institutes of Health, while their investigation of new, bimetallic systems is funded by the U.S. Department of Energy.

So far, their results show that they can make their materials 15,000 times more conductive upon initial battery use due to in-situ (that is, in the original material) generation of metallic silver nanoparticles. Their new approach to material design will allow development of higher-power, longer-life batteries than was previously possible.

These and other improvements are boosting interest in battery materials and the revolutionary devices that they may make possible.

"We may be heading toward a time when we can make batteries so tiny that they -- and the devices they power -- can simply be injected into the body," Takeuchi says.

Right now, her team is exploring how to boost the stability of the new materials they are designing for ICDs. The materials will be tested over weeks and months in laboratory ovens that mimic body temperature of 37 degrees Celsius.

"What's really exciting about this concept is that we are tuning the material at the atomic level," says Takeuchi. "So the change in its conductivity and performance is inherent to the material. We didn't add supplements to achieve that, we did it by changing the active material directly."

She explains that new and improved batteries for biomedical applications could, in a practical way, revolutionize treatments for some of the most persistent diseases by making feasible devices that would be implanted in the brain to treat stroke and mental illness, in the spine to treat chronic pain or in the vagal nerve system to treat migraines, Alzheimer's disease, anxiety, even obesity.

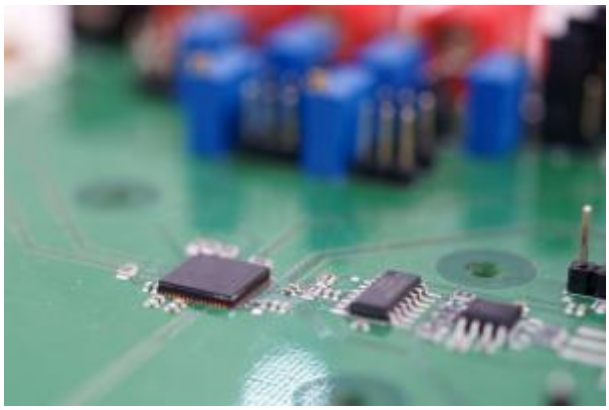
And even though batteries are an historic technology, they are far from mature, Takeuchi notes. This spring, she is teaching the energy storage course in UB's School of Engineering and Applied Sciences and the class is filled to capacity. "I've never seen interest in batteries as high as it is now," she says.

Story Source:

Adapted from materials provided by University at Buffalo.

http://www.sciencedaily.com/releases/2010/02/100210160150.htm

Battery-Less Radios Developed



Test board of IMEC and Holst Centre's wake up receiver. (Credit: IMEC)

ScienceDaily (Feb. 10, 2010) — At the International Solid State Circuit Conference, imec and Holst Centre report a 2.4GHz/915MHz wake-up receiver which consumes only 51µW power. This record low power achievement opens the door to battery-less or energy-harvesting based radios for a wide range of applications including long-range RFID and wireless sensor nodes for logistics, smart buildings, healthcare etc.

Today's battery-operated wireless communication systems consume a lot of power at times when the radio does not have to transmit or receive data. This means that most of their time Bluetooth or WLAN radios on mobile phones are taking energy from the battery without adding functionality. Imec and Holst Centre's wake-up receiver with ultra-low power consumption and fast response time can be put in parallel with the conventional radio to switch it on when data needs to received or transmitted.

Imec and Holst Centre developed an innovative radio architecture based on double sampling to overcome the 1/f noise problem. This noise affects most low data rate (10-100kbps) radios. As a consequence, these radios traditionally have a higher power budget than higher data rate radios achieving the same performance. By using a double-sampling technique the offset and 1/f noise is reduced and consequently the sensitivity of the receiver improves proportionally as data-rate scales.

The wake-up receiver chip was implemented in a 90nm digital CMOS technology and occupies an area of 0.36mm2. Measurements on silicon show a sensitivity of -75dBm (SNR>12dB) for the 915MHz receiver at 100kbps OOK (on off keying) modulation. When scaling the data rate to 10kbps and filtering the out-of-band noise, the sensitivity is improved by 5dB. For the 2.4GHz receiver, the sensitivity is -64dBm and -69dBm for 100kbps and 10kbps data rate respectively.

"Within our wireless autonomous sensor system research, we aim to develop wireless sensor systems powered by energy harvested from the environment instead of using batteries. The power budget of such systems is only 100µW for the DSP, radio and sensor. This ultra-low power radio of only 51µW with small form factor is a major step forward to achieve our goal. It opens the door to many new battery-less applications such as long-range RFID, smart lighting, and sensor tags." said Bert Gyselinckx, general manager imec the Netherlands at Holst Centre.

Story Source:

Adapted from materials provided by Interuniversity Microelectronics Centre (IMEC).

http://www.sciencedaily.com/releases/2010/02/100209124402.htm

Thirty-Eight Percent of World's Surface in Danger of Desertification

This is the Guadalquivir River as it passes through Seville, one of the areas most at risk of desertification in Spain. (Credit: Nesta Vázquez)

ScienceDaily (Feb. 10, 2010) — Researchers have measured the degradation of the planet's soil using the Life Cycle Assessment (LCA), a scientific methodology that analyses the environmental impact of human activities, and which now for the first time includes indicators on desertification. The results show that 38 percent of the world is made up of arid regions at risk of desertification.

"Despite improvements in the LCA, it has a methodological weakness, which is a lack of environmental impact categories to measure the effect of human activities such as cultivation or grazing on the soil," Montserrat Núñez, lead author and a researcher at the Institute of Agro Food Research and Technology (IRTA), said.

The research, published in the latest issue of the *International Journal of Life Cycle Assessment,* is the first study in the world to include the impact of desertification in the LCA, based on classifying 15 natural areas or "eco-regions" according to their degree of aridity. By simultaneously using the LCA and a Geographic Information System (GIS), the researchers have shown that eight of these 15 areas can be classified as at risk of desertification, representing 38% of the land surface of the world.

The eight natural areas at risk are coastal areas, the Prairies, the Mediterranean region, the savannah, the temperate Steppes, the temperate deserts, tropical and subtropical Steppes, and the tropical and subtropical deserts.

"The greatest risk of desertification (7.6 out of 10 on a scale produced using various desertification indicators) is in the subtropical desert regions -- North Africa, the countries of the Middle East, Australia, South West China and the western edge of South America," the scientist explains.

These are followed by areas such as the Mediterranean and the tropical and subtropical Steppes, both of which score 6.3 out of 10 on the scale of desertification risk. Coastal areas and the Prairies are at a lower risk of desertification, with 4 out of 10.

"Unsustainable land use may lead to soil becoming degraded. If this happens in arid, semi-arid and dry sub-humid regions, such as Spain, this degradation is known as desertification, and the effects can be irreversible, because they lead to areas becoming totally unproductive," says Núñez, who worked on the study with scientists from the Autonomous University of Barcelona and the National Technological University in Mendoza, Argentina.

In order to establish their methodology, the researchers used four biophysical variables that are the main causes of desertification -- aridity, erosion, over-exploitation of aquifers and risk of fire. "This makes it possible to satisfactorily evaluate the impact of desertification of a particular human activity, and compare the impact of the same activity in a different place, or the impact of different activities carried out in the same place," explains the researcher. The methodology proposed by the scientists is currently being put to use in various case studies in Spain and Argentina.

Completing the study of desertification

The new research shows that using the LCA in combination with GIS makes it easier to adapt the LCA to study the impacts of land use, not only in the case of desertification, but also in terms of loss of biodiversity, erosion, or even water consumption.

This new methodology will provide the Life Cycle Assessment (LCA) with an environmental impact category that will make it possible to measure "the desertification potential caused by any human activity," adds Núñez.

The Life Cycle Assessment (LCA) is a scientific methodology that objectively analyses the environmental impacts of an activity or process, taking in the full cycle, from extraction of raw materials right through to management of the waste generated at the end of this material's useful life.

Story Source:

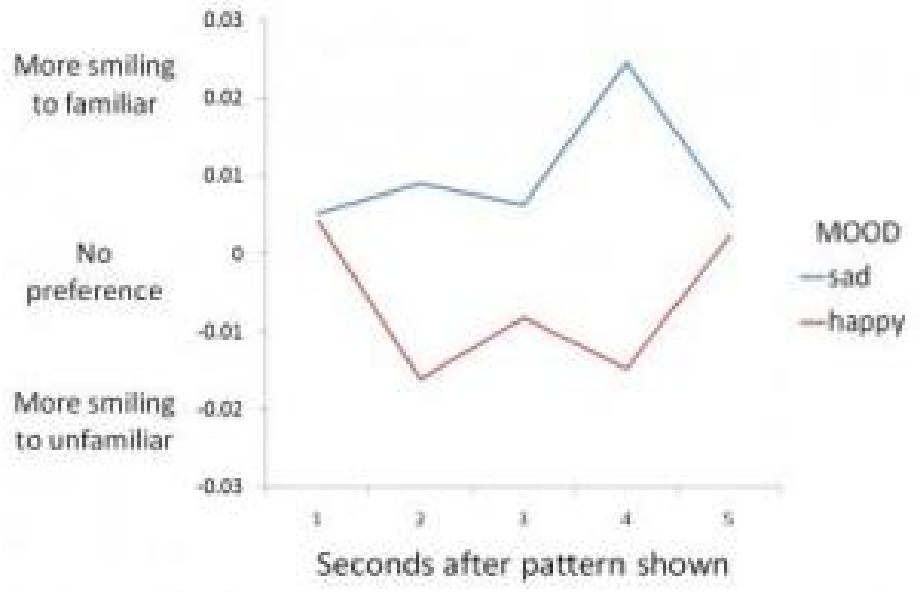
Adapted from materials provided by FECYT - Spanish Foundation for Science and Technology, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Núñez et al. **Assessing potential desertification environmental impact in life cycle assessment : Part 1: Methodological aspects**. *The International Journal of Life Cycle Assessment*, 2010; 15 (1): 67 DOI: 10.1007/s11367-009-0126-0

http://www.sciencedaily.com/releases/2010/02/100209183133.htm

Feeling Blue? You'll Shun the New



Subjects smiled more to the familiar in a sad mood and more to the unfamiliar in a happy mood. (Credit: Courtesy Piotr Winkielman, UC San Diego.)

ScienceDaily (Feb. 10, 2010) — A sick or sad child might cling to mom's leg. But that same child -- fed, rested and generally content -- will happily toddle off to explore every nook and cranny of the known world. Or: You're chipper and you decide to check out the new restaurant across town. You're blue and you turn to comfort foods.

If you've seen or experienced these scenarios, you may not be surprised about the latest finding from an international team of social and cognitive psychologists: A negative mood, it turns out, imparts a warm glow to the familiar. Happiness, on the other hand, makes novelty attractive (and can instead give the familiar a "blah" cast). But it is the first time the effect has been experimentally demonstrated in humans.

Led by University of California, San Diego psychology professor Piotr Winkielman, with Marieke de Vries, currently affiliated with the Leiden University Medical Center in the Netherlands, as first author on the paper, the study is published online in the journal *Psychological Science*.

The findings, Winkielman said, not only contribute to understanding basic human psychology but also have numerous applications: To parenting and other interpersonal relationships and even in many of the "persuasion professions." In business, in marketing and advertising and in political campaigns, people would be well-advised to take note of the research. When companies introduce novel products, for example, they may want to do so in settings that encourage a happy, playful mood. A surgeon's office, meanwhile, Winkielman said, which people visit rarely and in stressful circumstances, should probably stay away from edgy décor, opting instead for the comfy and familiar.

"The research helps us understand, too," said Winkielman, "why incumbent politicians seeking re-election fuel a negative, apprehensive mood and then offer up such tried-and-true symbols as the flag and apple pie."

It is a classic psychological observation that people prefer familiar stimuli, described 100 years ago by British psychologist Edward Titchener as the "warm glow of familiarity." In a century of research since, many studies have supported the notion and shown that even simple repetition will enhance liking of an object.

The current researchers wondered, however: Is familiarity always pleasant or warm? Perhaps, they reasoned, that varies with an individual's mood.

"We thought the value of familiarity would depend on the context," de Vries said. "Familiarity signals safety, which is pleasant in an unsafe or stressful context but might actually get boring when all is going fine."

They examined the idea by presenting participants with random dot patterns resembling constellations in the sky and made these familiar through exposure. The researchers put some of the participants in a good mood and others in a bad mood -- by asking them to recall joyous or sad events in their lives. They then maintained the mood by playing appropriate music during the remainder of the test. Finally, they measured participants' emotional and memory responses to the dot patterns with ratings and, critically, with physiological measures (skin conductors to assess sweat and facial electrodes to detect incipient frowns and smiles).

As predicted, saddened participants showed the classic preference for the familiar, even smiling at the sight of familiar patterns.

A happy mood, however, eliminated the preference.

"When you're happy," Winkielman said, "known things, familiar things lose their appeal. Novelty, on the other hand, becomes more attractive."

Winkielman noted, too, that the physiological measures of the responses are particularly telling: "These are immediate bodily reactions -- not just talk -- we're seeing genuine, if mild, emotional response."

The study follows up on Winkielman's earlier, related work on "beauty in averages" and on embodied emotion.

Other coauthors are Troy Chenier and Mark Starr of UC San Diego and Rob Holland of Radboud University Nijmegen, Netherlands.

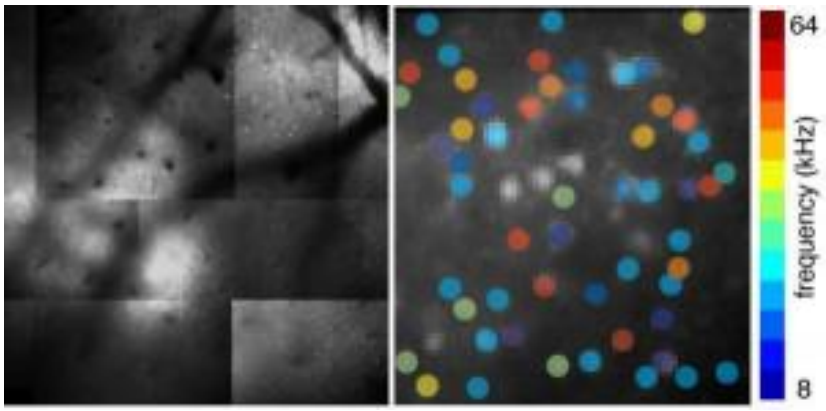
The research was supported by grants from the National Science Foundation to Winkielman, the European Association of Experimental Social Psychology and Radboud University Nijmegen to de Vries and the Dutch Science Foundation to Holland.

Story Source:

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

http://www.sciencedaily.com/releases/2010/02/100209183242.htm

Seeing the Brain Hear Reveals Surprises About How Sound Is Processed



The left shows thousands of dye-loaded cells in the mouse auditory cortex over a large area. The right shows the preferred frequency of many cells, and shows that neighboring cells can have dramatically different frequency preference. (Credit: Image courtesy of University of Maryland)

ScienceDaily (Feb. 10, 2010) — New research shows our brains are a lot more chaotic than previously thought, and that this might be a good thing. Neurobiologists at the University of Maryland have discovered information about how the brain processes sound that challenges previous understandings of the auditory cortex that suggested an organization based on precise neuronal maps. In the first study of the auditory cortex conducted using advanced imaging techniques, Patrick Kanold, Assistant Professor of Biology, Shihab Shamma, Professor of Electrical and Computer Engineering, and Sharba Bandyopadhyay, post-doctoral

"The organization of the cortex does not look as pretty as it does in the textbooks," says Dr. Kanold. "Things are a lot messier than expected." Images above: The left shows thousands of dye-loaded cells in the mouse auditory cortex over a large area. The right shows the preferred frequency of many cells, and shows that neighboring cells can have dramatically different frequency preference.

associate, describe a much more complex picture of neuronal activity. Their findings are published in the January 31 online edition of *Nature Neuroscience*.

All our knowledge of how the brain really works has been based on taking a small sampling of all available neurons and making inferences about how the other neurons respond, Dr. Kanold explains. "This is like showing someone who wants to know how America looks, 'Here is one person from New York City and one person from California.' You don't get a very good picture of what the country looks like from that sampling," says Kanold, originally from Germany.

In contrast, Kanold and colleagues were able to look at the activity of all the neurons in a large region of the auditory cortex simultaneously. To get the highest resolution picture to date of how auditory cortex neurons are organized, the researchers used a technique to fill neurons in living mice with a dye that glows brightly when calcium levels rise, a key signal that neurons are firing. They then selectively illuminated specific regions of the cortex with a laser and measured the neuronal activity of hundreds of neurons in response to stimulation by simple tones of different frequencies.

This "in vivo 2-photon calcium imaging" technique was developed by German researchers and advanced by Harvard scientists who used it to study the visual cortex in the mid-2000s. Kanold's study is the first to apply this technique to the auditory cortex and provides an unprecedented amount of detail about how hearing happens. Dr. Andrew King, Professor of Neurophysiology at the University of Oxford, explains that "The functional organization of the auditory cortex has remained unclear and a matter of some controversy, despite the efforts of many labs over a number of years. The approach used by Dr. Kanold and colleagues is an important advance in this field."

"We discovered that the organization of the cortex does not look as pretty as it does in the textbooks, which surprised us," explains Kanold. "Things are a lot messier than expected." And we don't see evidence of the maps previously proposed using less precise techniques." But the disorder they found could indicate that the brain is far more adaptable than previously thought. "These results may rewrite our classical views of how cortical circuits are organized and what functions they serve," suggests Dr. Shihab Shamma, whose previous research has involved mapping responses in the auditory cortex using traditional microelectrodes.

By using different dyes, this study measured differences in how the neurons receive sound information (the inputs), and how they process that sound (the outputs). It was previously assumed that neighboring neurons receiving the same inputs would also produce the same outputs, but Kanold's research found something very different. "Neighboring neurons do their own thing by creating different outputs," Kanold explains. "You can imagine that you and your neighbor both receive water to your houses from the same pipe, but you do different things with it -- you might cook with it while your neighbor waters the lawn. You can't assume that they are doing the same thing just because they are neighbors."

This is the first time that this level of individuality has been observed in neighboring neurons. Dr. Kanold, who is an expert in neuroplasticity, the brain's ability to reorganize neural pathways, believes that there is a tremendous advantage in this apparent disorder. "Each individual neuron is getting inputs from a wide range of frequencies, and by selecting which frequencies they are strongly responding to, they might be very easily able to shift their function," he says. For example, it is well known that we can quickly listen in on a variety of conversations around us, the so-called "cocktail party effect." It may be that neurons having access to a large range of inputs might be able to quickly change which inputs they are responding to.

This suggests that there is very little redundancy in the function of cells in the auditory cortex, which differs notably from the visual cortex, in which neighboring neurons perform the same function as one another. This could be because our acoustic environment, such as the speech we hear, changes much faster than our visual environment, so we have to constantly adapt to new situations.

Kanold continues to study the mechanisms of brain circuitry involved in early development to gain a better understanding of why we can learn so well in early development but lose some of this ability as we age. For example, why can children easily learn new languages, while adults often struggle? Kanold's work has been focusing on identifying circuits in the young brain that mediate this remarkable ability. He is also working to apply his knowledge of developmental brain circuitry to the prevention and treatment of diseases such as cerebral palsy and epilepsy, which can be caused by early brain injuries. With his collaborator Shihab Shamma, who is studying mechanisms of adult plasticity and hearing, he is exploring how brain circuitry and learning changes over time.

Story Source:

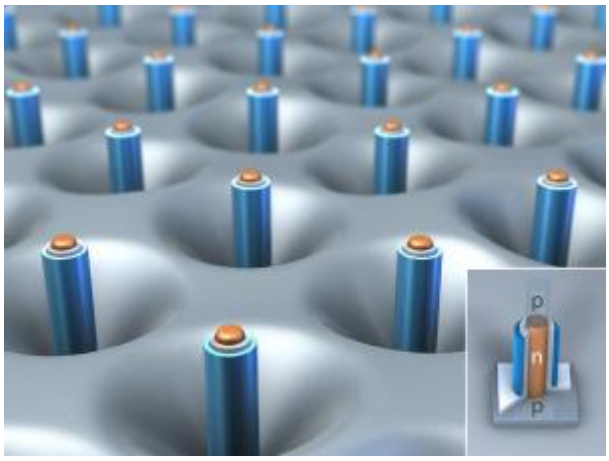
Adapted from materials provided by University of Maryland.

Journal Reference:

1. Bandyopadhyay et al. **Dichotomy of functional organization in the mouse auditory cortex**. *Nature Neuroscience*, 2010; DOI: 10.1038/nn.2490

http://www.sciencedaily.com/releases/2010/02/100201093037.htm

High, Not Flat: Nanowires for a New Chip Architecture



Scheme of a silicon wafer with novel vertical transistors made out of silicon nanowires (without the upper p-contact). (Credit: Image courtesy of Forschungszentrum Dresden Rossendorf)

ScienceDaily (Feb. 10, 2010) — A myriad of silicon transistors are responsible to pass on the information on a microchip with today's technology. The transistors are arranged in a planar array, i.e. lying flat next to each other, and have shrunk down already to a size of only about 50 nanometers (1 nanometer = 1 millionth part of 1 millimeter). Further miniaturization of transistors with a planar structure will soon come to an end due to fundamental physical limits. Still, even smaller transistors are desirable in order to continuously improve their functions while reducing the cost of the electronics.

Currently, researchers are working hard to find new approaches to overcome the physical limits on downscaling and integration of microchips. One such concept is to fabricate a completely new transistor architecture in three-dimensions. In this concept, instead of arranging them flat on the substrate the silicon transistors are turned by 90 degrees so that they stick out of the chip substrate like tiny columns. In this way, numerous vertical transistors could be built on the area normally occupied by only one planar transistor. This would finally be the step from micro to nanoelectronics.

The fabrication of vertical silicon nanowire arrays has already been reported. Yet there needs to be a more thorough research into the electrical properties of silicon nanowires in order to be able to build reliable transistors for a new generation of microchips. Unlike conventional transistors, the current flow in these column-like transistors will be vertical, and they will be smaller and more energy-saving than today. Last but not least, there are high hopes to fabricate extremely efficient solar cells using silicon nanowires.

The Max Planck researchers in Halle produce monocrystalline silicon nanowires which are particularly suitable as components for microchips. At the FZD's ion beam center, foreign atoms known as 'dopants' are implanted into the nanowires. The dopants occupy lattice sites of the host semiconductor increasing the electrical conductivity and the current flow through the semiconductor. Selective implantation of different dopants can change the polarity of the charge carriers in a transistor leading to the switching of the current flow. The planar silicon technology is well developed; however, this is not true for silicon nanostructures. "First, we analyzed wires with a diameter of 100 nanometers and 300 nanometers in length. But what we aim at are wires with a diameter of a few atoms only, as well as wires where individual atoms are strung together. We intend to closely characterize their behavior in materials and want to find out how their electrical properties can be tailored for application in nanoelectronics, e.g. for new field-effect transistors," say FZD physicists Dr. Reinhard Koegler and Dr. Xin Ou.

The nanowires were investigated in Rossendorf using a technique (Scanning Spreading Resistance Microscopy, SSRM) that usually measures the position- dependent electrical resistivity in a specially-prepared two-dimensional cross-section of the nanowire. The resistivity is related to the atomic

concentration of the dopants. In the current work, the researchers have found that the dopants in a silicon nanowire, namely boron and phorphorus, do not stay where they are expected, but drift to the surface of the nanowire where they become partially inactive and can no longer contribute to the electrical conductivity. Up until now scientists were lacking an appropriate technique to visualize and quantify the consequences of an unequal distribution of dopants at the nanoscale. Chip designers have to pay attention to the newly found results if nanowires are to be applied for vertical transistors in the future.

Story Source:

Adapted from materials provided by Forschungszentrum Dresden Rossendorf.

Journal Reference:

1. Ou et al. **Carrier Profiling of Individual Si Nanowires by Scanning Spreading Resistance Microscopy**. *Nano Letters*, 2010; 10 (1): 171 DOI: 10.1021/nl903228s

http://www.sciencedaily.com/releases/2010/02/100202103625.htm

Empire of Savagery in the Amazon
By GREG GRANDIN
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THE DEVIL AND MR. CASEMENT

One Man's Battle for Human Rights in South America's Heart of Darkness

By Jordan Goodman

Illustrated. 322 pp. Farrar, Straus & Giroux. $30

The 19th-century doctrine of progress held slavery and capitalism to be incompatible. Coercion, liberals believed, violated the ideals of natural rights and free labor. Wage work, Marxists thought, was more profitable than forced work, and that alone would doom slavery. Then in 1904, nearly four decades after Appomattox, Roger Casement, an Irish-born career diplomat in the British Foreign Office, wrote his Congo report, revealing that King Leopold of Belgium had enriched himself by presiding over a rubber trade founded on pure cruelty. "What has civilization itself been to them?" Casement asked of Leopold's Congolese victims, 10 million of whom, by some estimates, had perished in but two decades. He himself had the answer: "A thing of horror."

"The Devil and Mr. Casement," by Jordan Goodman, the author of several works of history, reconstructs the Casement investigation in the Putumayo region of the Amazon rain forest that followed the Congo report. There, the Peruvian Julio César Arana ruled over a rubber empire of 10,000 square miles, and from 1910 to 1913, Casement exhausted himself trying to force the British government to take action against Arana and his London-incorporated Peruvian Amazon Company. He twice traveled to the Amazon, collecting evidence of whipping, torture, mass rape, mutilation, executions and the hunting of the region's Indians, whose population Casement calculated had fallen to 8,000 in 1911 from 50,000 in 1906.

Goodman's book adds to Casement's reputation as a pioneer of the human rights movement's tactics, including the on-the-spot investigation, the gathering of victims' testimony and the leveraging of public outrage to spur reform. Casement was one of the first to use the phrase "crime against humanity," and he judged Arana to be guilty of "not merely slavery but extermination" — what later would be called genocide.

But Casement's moral trajectory ran opposite to that of many modern human rights activists. France's current foreign minister, Bernard Kouchner, for example, dropped his youthful support for national liberation movements to embrace what some have criticized as "humanitarian imperialism." Casement tried at first to use the services of a foreign office to ease suffering. Yet he veered off what he called the "high road to being a regular Imperialist jingo." His time in Congo and the Amazon deepened his sense of anticolonial solidarity. "I was looking at this tragedy," he said of Congolese slavery, "with the eyes of another race" — the Irish — "a people once hunted themselves." Knighted in 1911 for his humanitarian work, he was hanged by the British five years later for conspiring with the Germans on behalf of Irish independence.

Casement's execution is not the climax of Goodman's story, because this book doesn't have a climax. It tapers off without resolution. The British directors of Arana's company are interrogated by members of Parliament. Reports are issued, sermons are preached, politicians are outraged. Arana appears before Parliament's committee on the Putumayo, after which he boards a steamer back to Peru untouched. The reader is left to ponder the fate of his indigenous victims.

This is an apt ending to a fine and meticulous book, for a kind of slavery still remains in force in the Amazon. Thousands of workers, for instance, trapped in conditions nearly as dismal as those documented a century ago in the Putumayo, make the charcoal used to forge pig iron, which is then purchased by international corporations to produce the steel used in everyday products, including popular makes of cars.

Arana ultimately lost his company and died broke. Yet the devil continues to get the better of Mr. Casement.

Greg Grandin is the author, most recently, of "Fordlandia: The Rise and Fall of Henry Ford's Forgotten Jungle City."

http://www.nytimes.com/2010/02/14/books/review/Grandin-t.html?nl=books&emc=booksupdateema3

Jews and the Burden of Money

By CATHERINE RAMPELL
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CAPITALISM AND THE JEWS

By Jerry Z. Muller

267 pp. Princeton University Press. $24.95

The question of why so many Jews have been so good at making money is a touchy one. For hundreds of years, it has been fraught with suspicion, denial, resentment, guilt, self-hatred and violence. No wonder Jews and gentiles alike are so uncomfortable confronting Jewish capitalistic competence. Still, in his slim essay collection "Capitalism and the Jews," Jerry Z. Muller presents a provocative and accessible survey of how Jewish culture and historical accident ripened Jews for commercial success and why that success has earned them so much misfortune.

As Muller, a history professor at the Catholic University of America, explains it, much anti-Semitism can be attributed to a misunderstanding of basic economics. From Aristotle through the Renaissance (and then again in the 19th century, thanks to that Jew-baiting former Jew Karl Marx), thinkers believed that money should be considered sterile, a mere means of exchange incapable of producing additional value. Only labor could be truly productive, it was thought, and anyone who extracted money from money alone — that is, through interest — must surely be a parasite, or at the very least a fraud. The Bible also contended that charging interest was sinful, inspiring Dante to consign usurers to the seventh circle of hell (alongside sodomites and murderers). In other words, 500 years ago, the phrase "predatory lending" would have been considered redundant.

Lending at interest was thus forbidden across Christian Europe — for Christians. Jews, however, were permitted by the Roman Catholic Church to charge interest; since they were going to hell anyway, why not let them help growing economies function more efficiently? (According to Halakha, or Jewish law, Jews were not allowed to charge interest to one another, just to gentiles.) And so it was, Muller explains, that Judaism became forever fused in the popular mind with finance. In fact, Christian moneylenders were sometimes legally designated as temporary Jews when they lent money to English and French kings.

As Europe's official moneylenders, Jews became both necessary and despised. The exorbitant interest rates they charged — sometimes as high as 60 percent — only fed the fury. But considering the economic

climate, such rates probably made good business sense: capital was scarce, and lenders frequently risked having their debtors' obligations canceled or their own assets arbitrarily seized by the crown.

This early, semi-exclusive exposure to finance, coupled with a culture that valued literacy, abstract thinking, trade and specialization (the Babylonian Talmud amazingly presaged Adam Smith's paradigmatic pin factory), gave Jews the human capital necessary to succeed in modern capitalism. It also helped that Judaism, unlike many strains of Christianity, did not consider poverty particularly ennobling.

Most of Muller's strongest arguments are in his first essay, which draws on everyone from Voltaire to Osama bin Laden to illustrate how the world came to conflate the negative stereotypes of Jews with those of capitalism's excesses. The book's remaining three essays deal somewhat unevenly with the fallout of the Jews' economic success, and in particular the resentment it inspired among history's economic also-rans. Muller explores, for example, how Jews improbably became associated with both abhorred poles of political economy: hypercapitalism and Communism.

Some Jews had indeed sought refuge from anti-Semitism in the seamless brotherhood imagined by Communism (as others did in the nationalist rebirth promised by Zionism). But in a mostly perfunctory history of socialism in Eastern Europe, Muller argues that "Judeo-Bolshevism" was a myth, promoted perhaps to malign the Communist movement.

Of course, just as often this stigma-by-association has run in the opposite direction: from economic phenomena that commentators have found distasteful, to the Jews (see "Hitler"). But such smears and scapegoating stuck largely because Jews had, for centuries, been thoroughly identified with other capitalist-conspiracy theories.

While this book is ostensibly about "the Jews," Muller's most chilling insights are about their enemies, and the creative, almost supernatural, malleability of anti-Semitism itself. For centuries, poverty, paranoia and financial illiteracy have combined into a dangerous brew — one that has made economic virtuosity look suspiciously like social vice.

Catherine Rampell is the economics editor at NYTimes.com.

http://www.nytimes.com/2010/02/14/books/review/Rampell-t.html?nl=books&emc=booksupdateema3

Freedom's Laboratory

By GARY ROSEN
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THE SCIENCE OF LIBERTY

Democracy, Reason, and the Laws of Nature

By Timothy Ferris

368 pp. Harper/HarperCollins Publishers. $26.99

To say that the scientific frame of mind has played an important part in the rise of the West is not exactly controversial. Science always gets its moment in the spotlight in "Whig history," as historians (dismissively) call grand narratives of political and material progress. In "The Science of Liberty," the veteran science writer Timothy Ferris makes a more extravagant claim, assigning not a mere supporting role but top billing to the celebrated experimenters and inventors of the past several centuries. As he sees it, the standard account of the history textbooks — with the Renaissance giving rise to the Scientific Revolution and thus preparing the way for the Enlightenment — fails to identify the primary causal relationship. Democratic governance and individual rights did not emerge from some amorphous "brew of humanistic and scientific thinking," he argues, but were "sparked" by science itself — the crucial "innovative ingredient" that "continues to foster political freedom today."

Ferris, the author of "The Whole Shebang" and a number of other books about cosmology, usefully reminds us that science was an integral part of the intellectual equipment of the great pioneers of political and individual liberty. John Locke was not just the most eloquent philosophical advocate of the social contract and natural rights. He was an active member of the emerging scientific culture of 17th-century Oxford, and his intimates included Isaac Newton, who likewise was a radical Whig, supporting Parliament against the overreaching of the crown. Among the American founders, the scientific preoccupations of Franklin and Jefferson are well known, but Ferris emphasizes that they were hardly alone in their interests. He recounts a charming episode, for instance, in which George Washington and Thomas Paine floated together one night down a New Jersey creek, lighting cartridge paper at the water's surface to determine whose theory was correct about the source of swamp gas. Ferris also neatly summarizes the prehistory of modern science's ascent, with subtle takes on Galileo's clash with church authorities and Francis Bacon's inductive method.

The most engaging chapters in "The Science of Liberty" concern the dynamic interplay of technology and commerce. As Ferris recognizes, the seemingly irresistible spread of modern principles of liberty derives in large measure from the capacity of modern industrial democracies to deliver the goods in terms of general prosperity, health and diversion. The practical side of the scientific outlook has generated endless rounds of invention and innovation (Watt and his steam engine, Morse and his telegraph, Edison and his electric lights, etc.), and the human benefits of these time- and labor-saving improvements have been extended dramatically, if haltingly, by the free market. The singular insight of Adam Smith, Ferris writes, was to recognize that wealth creation and the production of material comforts might be "increased indefinitely if individuals are free to invest and to innovate."

By this point in his ambitious narrative, however, Ferris has given up on any real effort to argue for the decisive influence of science as such. He is content to speak of science metaphorically, as the model for

openness and experimentalism in all the major realms of liberal-democratic endeavor. Thus, just as in his account of Smith's free-market economics, Ferris finds in the United States Constitution the underlying principle that citizens should "be free to experiment, assess the results and conduct new experiments." The American Republic might be compared to "a scientific laboratory," he writes, because it is designed "not to guide society toward a specified goal, but to sustain the experimental process itself."

Ferris's refrain of "experiment" is a well-chosen trope. Few other words in the vocabulary of Western progress can match its prestige and practical appeal. To rely on experiment is to doubt authority, to cultivate self-awareness, to seek the reality behind natural appearances and received opinion. The experimental frame of mind encompasses the scientist in her lab, the inventor in his workshop and even (with some literary license) the reflective bohemian, the calculating entrepreneur and the shrewd democratic leader. But does it yield the "laws of nature" from which Locke and Jefferson drew the idea of universal human rights? Does it explain our reluctance today to compromise those rights in the name of expediency or results? Jeremy Bentham dismissed the idea of natural rights as "nonsense upon stilts," because it stood in the way of a proper utilitarian calculus of human welfare. Arguably, one can find his heirs today atop the Chinese state, conducting technocratic experiments of their own and deploying the tools of modern science (Google beware!) to preserve a "harmonious society." For the politics of liberty, mere empiricism is not enough.

Ferris is on firm ground in arguing that the political influence of the scientific enterprise has been liberalizing and progressive, on the whole. Whig history has its virtues. And he provides convincing indictments of various illiberal ideologies, from Nazism and Soviet Communism to postmodernist cultural theory, for their incompatibility with scientific inquiry. He would have done his readers a favor, however, by approaching the ideas of liberalism's most penetrating philosophical critics with more generosity; his tendency is to jeer and dismiss. Rousseau, Marx and Heidegger have indeed inspired a range of noxious intellectual and political movements, but they still have things to teach us about the failings and vulnerabilities of liberal-democratic societies.

Nor is it clear, as Ferris would have it, that science furnishes the ideal template for liberal democracy. Science, he notes, is antiauthoritarian, self-correcting, meritocratic and collaborative. As John Dewey, one of his heroes, put it, "freedom of inquiry, toleration of diverse views, freedom of communication, the distribution of what is found out to every individual as the ultimate intellectual consumer" are all as "involved in the democratic as in the scientific method." In a like vein, Ferris also cites the theoretical physicist Lee Smolin: "Good science comes from the collision of contradictory ideas, from conflict, from people trying to do better than their teachers did, and I think here we have a model for what a democratic society is about."

But crucial distinctions are lost in these comparisons. The scientific community may be open to everyone, in principle, but it has steep and familiar barriers to entry, as any layperson who has tried to read the research papers at the back of journals like Nature or Science can attest. When not distorted by its own personal and political rivalries, modern science is, in the most admirable sense, an aristocracy — a selection and sorting of the best minds as they interact within institutions designed to achieve certain rarefied ends. Experiment, equality and freedom of expression are essential to this work, but it is the work of an elite community from which most people are necessarily excluded. Thankfully, participation in the everyday life of democracy does not require a Ph.D., nor are theories and ideas its basic medium.

Scientists today are understandably eager to shape policy debates on a number of urgent issues (like climate change, to which Ferris devotes much of his closing chapter). But they have to appreciate the many ways in which scientific discourse, even in its experimental mode, makes an awkward fit with democratic politics. Only then will they find it easier to talk to — and persuade — the rest of us.

Gary Rosen is the chief external affairs officer of the John Templeton Foundation.

http://www.nytimes.com/2010/02/14/books/review/Rosen-t.html?nl=books&emc=booksupdateema3

Do speedy elephants walk or run?

By Rebecca Morelle
Science reporter, BBC News

With their awkward, lumbering gait, elephants moving at high speed are not the most graceful of animals - but are they walking or running?

Now scientists believe they have an answer: new research confirms that they do both - at the same time.

By observing elephants moving across a hi-tech track, the team found the hefty creatures run with their front legs but walk with their back legs.

The research is published in the Journal of Experimental Biology.

Earlier research had suggested that elephants perform a strange, part-walk/part-run while travelling at speed.

But a team from Belgium, Italy and Thailand was able to investigate this further by using a specially built track that was able to precisely measure the forces exerted with each weighty elephant step.

Professor Norman Heglund, an author of the paper from the Catholic University of Louvain, Belgium, told BBC News: "We had to build the plates - you just can't go down to your local hardware shop and pick up an elephant-sized force plate."

Armed with these, the researchers headed to the Thai Elephant Conservation Centre to study the big beasts, which ranged from an 870kg baby to a four tonne adult.

Energetic exchanges

The Asian elephants were encouraged to move across the track, at speed, by their keepers - or mahouts - who rode on their backs (in the conservation centre, the elephants, which were rescued from the forest industry, are paired with their mahouts for life).

The fastest elephant reached 18km per hour (11mph).

They were also filmed using high-speed cameras.

By comparing the measurements from the sensitive force-measuring platform with each frame of the footage, the scientists were able to look at every tiny movement that the elephants were making.

This enabled them to calculate the amounts of potential energy (stored energy) and kinetic energy (the energy that is associated movement), that the creatures were using.

Measuring the relationship between potential and kinetic energy is the key to defining whether something is walking or running.

For example, when walking, as an animal raises its foot from the ground and moves it forwards, it is converting the stored energy in its muscles and tendons - the potential energy - into kinetic energy.

As its foot lands, the kinetic energy converts back into potential energy, and then back into kinetic energy as the foot is once again raised, and so on. All the time the creature is walking, the energy is transferred back and forth between potential and kinetic energy.

But while running, the potential energy and kinetic energy fluctuates simultaneously.

Professor Heglund explains: "The running gait, in most animals, is a bouncing mechanism.

"In this case, the potential and kinetic energy are in phase, they both hit a maximum at the same time and a minimum at the same time, so they cannot be transferred back and forth."

However, the researchers found that fast-moving elephants seem to both run and walk at the same time.

Professor Heglund said: "When an elephant goes at higher and higher speeds, the kinetic and potential energy shift and start to become more in phase.

"But when we looked in detail, we see that the animal appears to be running - bouncing - with the front legs, and walking with the back legs.

"It is as if he is getting up to a transition speed where he wants to transition from a walk to a run, but he cant quite do it. It's like he can't quite get up into second gear."

As well as confirming high-speed movements, the team also used the pressure plates to find out that elephants were also extremely economical with their movements, especially compared with smaller animals.

The scientists now plan to look at other large animals, such as hippos and rhinos, to find out if they run or walk.

This latest study confirms the findings of other research, published in the journal Nature and the Journal of Experimental Biology, that have previously shown that elephants perform a run-walk hybrid.

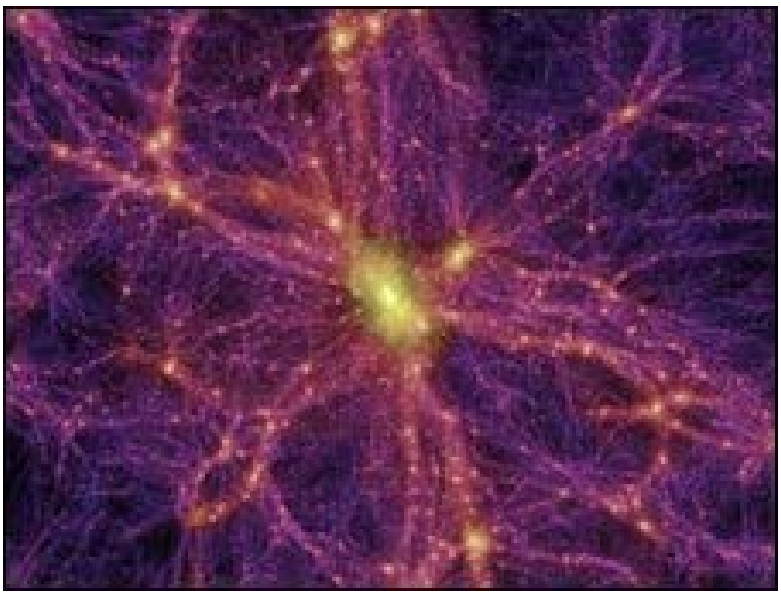
However, there are some differences - while this latest paper suggests the front legs run and the back legs walk, the other studies suggested the opposite.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8508796.stm

Published: 2010/02/12 05:06:05 GMT

Study hints at dark matter action
By Doreen Walton
Science reporter, BBC News

Researchers in the US say they have detected two signals which could possibly indicate the presence of particles of dark matter.



But the study in Science journal reports the statistical likelihood of a detection of dark matter as 23%.

Deep underground in a lab in Minnesota experiments to detect WIMPS, or Weakly Interacting Massive Particles have been going on since 2003.

Scientists are currently developing an even more sensitive experiment.

"It's a very difficult situation," said Professor Jodi Cooley from Southern Methodist University, Dallas in the US, who led the research.

"In some ways I feel we've been very unlucky.

" **It's a very exciting time in the field** "
Professor Jodi Cooley, Southern Methodist University

"Either we had a statistical fluctuation in our background or it could be that these two events are evidence of dark matter but there weren't enough of them to be sure.

"We can't rule them out as being a signal but we can't conclude that they are a signal."

The Cryogenic Dark Matter Search (CDMS), an experiment designed to detect the dark matter particles, is a joint effort by several US universities and institutes.

The scientists describe dark matter as being "the gravitational scaffolding that caused normal matter to coalesce into the galaxies we see today".

Ordinary matter - gas, stars, planets and galaxies - is thought to make up less than 5% of the Universe. The rest of the cosmos is unseen, 70% is thought to be "dark energy" and of this 25% of this is believed to be dark matter.

Different theories

Some scientists believe dark matter is made up of WIMP subatomic particles.

These are thought to have a similar mass to the nuclei that give each atom the majority of its mass, but are predicted to "bounce off" rather than interact with any other matter.

This would make the particles themselves impossible to find. So the detectors in the CDMS experiment are designed to pick up the tiny amount of energy that Wimps leave behind as they scatter - the only clue that might remain.

Other scientists argue that that the dark substance consists of everyday matter, but that this ordinary matter, referred to as Massive Astrophysical Compact Halo Objects (Machos), happens to radiate little or no light.

Professor Cooley hopes that the new experiment that's being developed will speed up the process of looking for evidence of dark matter.

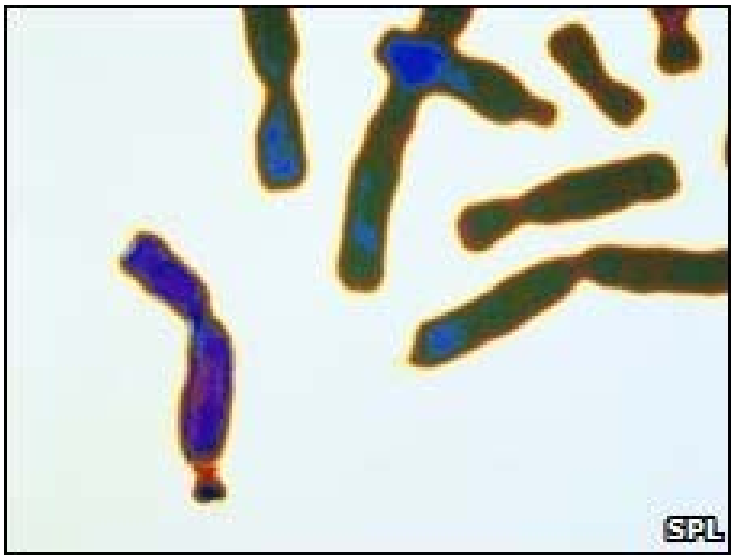
"It's a very exciting time in the field," she added.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/8508662.stm

Published: 2010/02/11 20:50:31 GMT

Clue over autism 'hug avoidance'

Delays at crucial points during the development of the brain in the womb may explain why people with a condition linked to autism do not like hugs.



A study in mice with fragile X syndrome found wiring in the part of the brain that responds to touch is formed late.

The findings may help explain why people with the condition are hypersensitive to physical contact, the researchers wrote in Neuron.

It also points to key stages when treatment could be most effective.

Fragile X syndrome is caused by a mutant gene in the X chromosome that interferes in the production of a protein called fragile X mental retardation protein (FMRP).

Under normal circumstances, the protein directs the formation of other proteins that build synapses in the brain.

" **It also has implications for the treatment of autism since the changes in the brains of fragile X and autistic people are thought to significantly overlap** "
Professor Peter Kind, Study author

Boys are usually more severely affected with the condition - which is the leading known cause of autism - because they have only one X chromosome.

In addition to mental impairment, hyperactivity, emotional and behavioural problems, anxiety and mood swings, people with fragile X also show what doctors call "tactile defensiveness", which means they do not make eye contact and do not like physical contact and are hypersensitive to touch and sound.

Connections

By recording electrical signals in the brains of mice, bred to mimic the condition, the researchers found that connections in the sensory cortex in the brain were late to mature.

This "mistiming" may trigger a domino effect and cause further problems with the correct wiring of the brain, they concluded.

The study also found these changes in the brain's connections occur much earlier than previously thought, midway through a baby's development in the womb.

And it suggests there are key "windows" when treatments for fragile X and autism could be most effective, they said.

Professor Peter Kind, who led the study at the University of Edinburgh, added: "We've learned these changes happen much earlier than previously thought, which gives valuable insight into when we should begin therapeutic intervention for people with these conditions.

"It also has implications for the treatment of autism since the changes in the brains of fragile X and autistic people are thought to significantly overlap."

Dr Gina Gómez de la Cuesta, from the National Autistic Society, said research into fragile X syndrome could help understanding of certain aspects of autism.

"Autism is common in people with fragile X syndrome, however there are many other causes of autism, most of which are not yet fully understood.

"Understanding how the brain works when a person has fragile X syndrome could help put some of the pieces together about what is happening in the brain when a person has autism, but it is not the whole story.

"Animal research can tell us a lot about genetics and the brain, but it is only a small part of the picture and further research would be required before we fully understand any links to autism."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8511100.stm

Published: 2010/02/12 00:00:08 GMT

Genes behind stammering uncovered

Stammering has long been recognised to run in families, but scientists now say they have identified three genes which may cause the problem in some people.

They believe that mutations which have already been tied to metabolic disorders may also affect the way in which parts of the brain function.

The study involving cases in Pakistan, the US and England appears in the New England Journal of Medicine.

Stammering affects about 1% of all adults worldwide.

Those affected repeat or prolong sounds, syllables or words, disrupting the normal flow of speech.

With early intervention children who stammer can overcome the problem, while for adults therapies are based on reducing anxiety and regulating breathing to improve speech.

But the team from the National Institute on Deafness and Other Communication Disorders (NIDCD) hopes its discovery may pave the way for new treatments.

Nearly one in ten of the sufferers examined were found to have a mutation in one of three genes.

Metabolic problems

Two of these, GNPTAB and GNPTG, have already been linked to two serious metabolic diseases in which components of cells are not effectively recycled.

" **In addition to finding new forms of treatment, we hope this may help us identifying those children at risk of persistent stammering as it is only through early intervention that they have a chance of recovering fluent speech** "
British Stammering Association

These disorders, known as lyposomal storage disorders, lead to a build-up of a potentially dangerous substance which can cause problems in almost every area of the body, including the brain.

People with this defective gene need two copies to develop the metabolic disorder, but one copy appears to be associated with stammering.

A third defective gene, which is closely related to the other two, was also found among stammerers but not among the controls.

"For hundreds of years, the cause of stuttering has remained a mystery for researchers and health care professionals alike, not to mention people who stutter and their families," said James Battey, head of the NIDCD.

"This is the first study to pinpoint specific gene mutations as the potential cause of stuttering, and by doing so, might lead to a dramatic expansion in our options for treatment."

The metabolic disorders pinpointed can be treated by injecting a manufactured enzyme into a person's bloodstream to take the place of the enzyme the body fails to produce. It is possible stammering, if confirmed to be caused by the same defect, would respond to the same treatment.

The British Stammering Association welcomed the findings.

"It is just the latest in a string of recent discoveries highlighting the fact that the cause of stammering is physiological - a symptom that, for whatever reason, the brain's neural circuits for speech are not being wired normally," said its director Norbert Lieckfeldt.

"This puts into sharp relief the bullying and ridicule people who stammer often experience, as opposed to people experiencing, for instance, mobility disabilities.

"In addition to finding new forms of treatment, we hope this may help us identifying those children at risk of persistent stammering as it is only through early intervention that they have a chance of recovering fluent speech."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/8507086.stm

Published: 2010/02/11 00:01:43 GMT

Bored to Death? It Could Happen

The more bored you are, the more likely you are to die early, according to researchers.
Wed Feb 10, 2010 01:20 PM ET | content provided by Maria Cheng, Associated Press

THE GIST:

- **Boredom alone isn't likely to kill you -- but it could be a symptom of other risky behavior.**
- **Other experts said while the research was preliminary, the link between boredom and increased heart problems was possible -- if not direct.**
- **When people are bored, dangerous hormones may be released in the body that stress the heart.**

Can you really be bored to death?

In a commentary to be published in the *International Journal of Epidemiology* in April, experts say there's a possibility that the more bored you are, the more likely you are to die early.

Annie Britton and Martin Shipley of University College London caution that boredom alone isn't likely to kill you -- but it could be a symptom of other risky behavior like drinking, smoking, taking drugs or having a psychological problem.

The researchers analyzed questionnaires completed between 1985 and 1988 by more than 7,500 London civil servants ages 35 to 55. The civil servants were asked if they had felt bored at work during the previous month.

Britton and Shipley then tracked down how many of the participants had died by April 2009. Those who reported they had been very bored were two and a half times more likely to die of a heart problem than those who hadn't reported being bored.

But when the authors made a statistical adjustment for other potential risk factors, like physical activity levels and employment grade, the effect was reduced.

Other experts said while the research was preliminary, the link between boredom and increased heart problems was possible -- if not direct.

"Someone who is bored may not be motivated to eat well, exercise, and have a heart-healthy lifestyle. That may make them more likely to have a cardiovascular event," said Dr. Christopher Cannon, an associate professor of medicine at Harvard University and spokesman for the American College of Cardiology.

He also said if people's boredom was ultimately linked to depression, it wouldn't be surprising if they were more susceptible to heart attacks; depression has long been recognized as a risk factor for heart disease. Cannon also said it was possible that when people are bored, dangerous hormones are released in the body that stress the heart.

Britton and Shipley said boredom was probably not in itself that deadly. "The state of boredom is almost certainly a proxy for other risk factors," they wrote. "It is likely that those who were bored were also in poor health."

Others said boredom was potentially as dangerous as stress.

"Boredom is not innocuous," said Sandi Mann, a senior lecturer in occupational psychology at the University of Central Lancashire who studies boredom.

She said boredom is linked to anger suppression, which can raise blood pressure and suppress the body's natural immunity. "People who are bored also tend to eat and drink more, and they're probably not eating carrots and celery sticks," she said.

Still, Mann said it was only people who were chronically bored who should be worried.

"Everybody is bored from time to time," she said.

http://news.discovery.com/human/boredom-early-death.html

Road Salt's Damaging Effects Prompt Tech Alternatives

Salt does a great job of keeping roads safe -- but at an environmental price.

By Jessica Marshall | Fri Feb 12, 2010 07:07 AM ET

THE GIST:

- **More than 22 million tons of road salt are used annually nationwide.**
- **Road salt threatens plants, aquatic life and groundwater.**
- **High-tech application strategies, though costly, can dramatically reduce salt requirements.**

"Let it snow" may be a charming sentiment when you can stay home with a cup of hot cocoa, but when you have to get somewhere, or for the trucks that haul critical supplies, clear roads make the journey safer.

For those who have to hit the highways, road salt is, literally, a lifesaver.

The problem is, the more than 22 million tons of road salt used nationwide each year don't just disappear after the snow melts. And evidence is growing that the salt concentration of streams, lakes and groundwater is steadily increasing. Salt levels in some places are high enough to harm roadside plants and aquatic life.

"Salt is a natural ingredient, but what is not natural is the concentrations," said Richard Hanneman, President of the Salt Institute, based in Alexandria, Va.

The good news is, many agencies are using alternative chemicals and new technologies that allow less salt to be used. Unfortunately, many of these approaches are prohibitively expensive.

Although the eastern seaboard, buried under record-breaking snows, welcomed shiploads of salt into ports this week, the amounts used are probably not of environmental concern, said John Burkhardt, who heads a national Transportation Research Board committee on winter road maintenance.

But a snowy city like Minneapolis-St. Paul uses 260 pounds of road salt per person each winter, according to calculations by Larry Baker of the University of Minnesota Water Resources Center based on another study, which found steadily rising salt concentrations in the cities' lakes. Five local streams are designated as "impaired" owing to high salt concentrations.

Dissolved salt lowers the freezing temperature of water. Since the 1950s, it has been dumped on top of packed layers of snow and ice in sufficient quantities to melt through to the pavement, where it thaws the bond between the ice and the road surface, making it easier for the plows to scrape the road clear.

Salt's effectiveness depends on temperature. "At warm temperatures, a little salt melts a lot of ice. At low temperatures, a lot of salt only melts a little ice," said Kathleen Schaefer of the Minnesota Department of Transportation and the University of Minnesota. Regular road salt is only effective from near freezing to about 15 degrees Fahrenheit. Below that, crews mix in other de-icers like magnesium chloride or calcium chloride, which can work down to well below zero Fahrenheit.

Salt use has climbed steadily since World War II, with road salt representing 65 percent of total U.S. salt sales.

"People simply expect to drive on dry pavement four hours after a snowstorm. Our expectations are very, very high," Baker said.

All this salt leads to briny conditions come spring. "At the peak, when you have a big melt, you can get concentrations about one-third that of seawater," Baker said.

It is the chloride ions that do much of the environmental damage. The chloride ions dehydrate plants, can kill small aquatic organisms and reduce water circulation in lakes that helps to aerate the water. Chemicals without chloride are available, such as potassium acetate, but these are several times more expensive than salt.

To combat environmental concerns, agencies across the country are using smarter techniques to minimize the use of salt while achieving the same performance.

"The crews need to understand that if 300 pounds per lane mile is good, 600 pounds is not better," Hanneman said.

New techniques include "anti-icing," in which salt solutions are sprayed down before the storm. This prevents the ice from freezing to the road in the first place, effectively making a non-stick coating on the roads.

Wetting the salt before applying also keeps more on the roads where its needed, instead of bouncing off onto roadsides.

Smart plow trucks equipped with computers track storm conditions, pavement temperatures, and local weather to constantly update the optimal amount of salt that should be applied.

The state of Indiana implemented this approach last winter, saving 228,000 tons of salt, and more than $13 million dollars in salt and overtime costs, according to a state report.

In addition to environmental benefits, using less salt slows its corrosive effects on bridges and cars.

Non-chemical means could also help, Schaefer said. One Minnesota community is testing a pervious pavement surface so that melting snow soaks right through, rather than running off into waterways.

New plow blade designs could be more effective at removing the last layer of snow, she added. Even heating the roads with heat tubing underneath the concrete could be an option, especially on bridges, for instance.

"I think we need to take an innovative approach and say, we don't have one silver bullet," she said.

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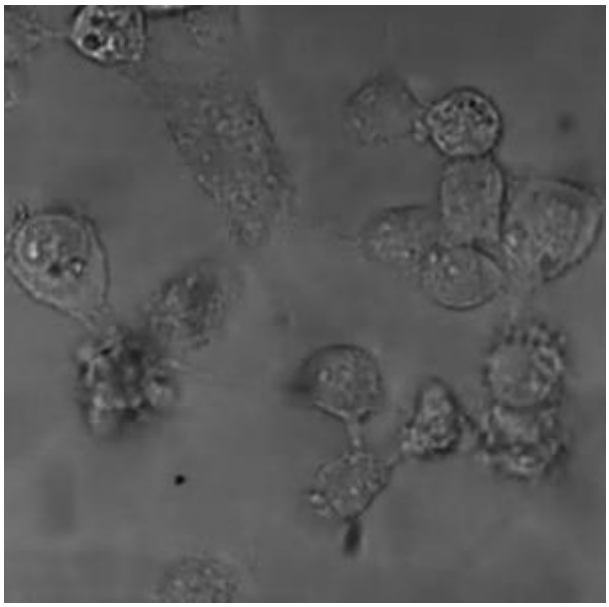
http://news.discovery.com/earth/salt-roads-environment-technology.html

Nanomaterials May Help Fight Cancer



Still image from a video showing cancer cells self-destructing after being tagged with nanodiscs and exposed to a light magnetic field. (Credit: Image courtesy of DOE/Argonne National Laboratory)

ScienceDaily (Feb. 12, 2010) — Scientists from the U.S. Department of Energy's Argonne National Laboratory and the University of Chicago Medical Center are shaking up the world of materials science and cancer research on the cover of the February 2010 issue of the journal *Nature Materials*.

Brain cancer is notoriously difficult to treat with standard cancer-fighting methods, so scientists have been looking outside standard medicine and into nanomaterials as a treatment alternative.

"Our mission is to develop advanced 'smart' materials with unique properties," said Elena Rozhkova, a nanoscientist with Argonne's Center for Nanoscale Materials. "These efforts are directed to the improvement of the national quality of life, including creating novel medical technologies."

A team of scientists, including Rozhkova, Dong-Hyum Kim, Valentyn Novosad, Tijana Rajh and Samuel Bader from Argonne, and Maciej Lesniak and Ilya Ulasov from the University of Chicago Brain Tumor Center, developed a technique that uses gold-plated iron-nickel microdiscs connected to brain-cancer-seeking antibodies to fight cancer. The microdiscs are an example of a nanomagnetic material and can be used to probe cell mechanics and activate mechanosensitive ion channels, as well as to advance cancer therapies.

The discs posses a spin-vortex ground state and sit dormant on the cancer cell until a small alternating magnetic field is applied and the vortices shift, creating an oscillation. The energy from the oscillation is transferred to the cell and triggers apoptosis, or "cell suicide."

Since the antibodies are attracted only to brain cancer cells, the process leaves surrounding healthy cells unharmed. This makes them unlike traditional cancer treatment methods, such as chemotherapy and radiation, which negatively affect both cancer and normal healthy cells.

"We are very excited about this melding of materials and life sciences, but we are still in the very early research stages," materials scientist Valentyn Novosad said. "We are planning to begin testing in animals soon, but we are several years away from human trials. Everything is still experimental."

Along with continued testing and research of the treatment, scientists also have to examine any possible side effects that have been so far unseen in the laboratory.

"The use of nanomaterials for cancer treatment is not a new concept, but the ability to kill the cells without harming surrounding healthy cells has incredible potential," Rozhkova said. "Such a topic can only be approached with the expertise of markedly differing disciplines such as physics, chemistry, biology and nanotechnology and can make a great impact in important areas of science and modern advanced technologies."

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Story Source:

Adapted from materials provided by DOE/Argonne National Laboratory.

http://www.sciencedaily.com/releases/2010/02/100210211731.htm

Environmental Disaster in Southern Spain Compared With Cretaceous Mass Extinction

Researchers have compared the Aznalcóllar disaster with the Cretaceous mass extinction. (Credit: SINC)

ScienceDaily (Feb. 12, 2010) — Researchers from the University of Granada (UGR) have compared the disaster caused by the Aznalcóllar spillage in the Doñana National Park in Andalusia 11 years ago with the biggest species extinction known to date. What do these two disasters have in common? The scientists say that carrying out comparisons of this kind will make it possible to find out how ecosystems recover following mass extinctions.

Until now, scientists used to study the fossil record in order to analyse how organisms responded to major environmental changes in the past, such as the mass extinction of species during the Cretaceous period (65 million years ago) and their subsequent recovery.

Now a team of scientists from the UGR has proposed a different methodology: "Another way of looking at this issue is to compare present day disasters that have also caused an abrupt ecological change, and which have therefore also had a major impact on organisms," says Francisco Javier Rodríguez-Tovar, lead author of the study and a researcher at the UGR's Department of Stratigraphy and Palaeontology.

The study, published recently in the journal *Geobiology*, was based on "one of the worst environmental disasters to have happened in Spain over recent decades."

The pyrite mine at Aznalcóllar, in the Doñana National Park, burst on 25 April 1988, spilling four million cubic metres of acidic water and one million cubic metres of waste material containing high levels of toxic compounds, which affected more than 4,500 hectares of the rivers Agrio and Guadiamar and the land around them.

The researchers carried out a detailed analysis of how the pollution from Aznalcóllar evolved, and how the local plant and animal communities responded following the event, by studying the affected soil.

"Comparing this with what happened 65 million years ago could help to better interpret this past event," explains Rodríguez-Tovar.

The similarities are obvious -- sudden impact, high levels of toxic compounds, and the existence of a polluted layer covering the affected area. However, the scientist also points out some of the most significant differences, such as recovery following the impact, which was "much faster after the disaster at Aznalcóllar," and in terms of the area affected, which was "global for the Cretaceous-Tertiary boundary event," says Rodríguez-Tovar.

In search of signs of life

The scientists were able to carry out a range of experiments on the layers of mud that have not been removed from Doñana. Geochemical analysis showed that "there is still significant contamination, with high concentrations of toxic elements, and high acidity levels," stresses the palaeontologist. However, less than 10 years after the disaster, the scientists could identify trails and nests made by Tapinoma nigérrima, an aggressive and opportunistic species of ant. "We even found this ant's larvae just below the layer of highly-contaminated mud," explains the expert.

This ant's opportunism, aggressiveness and high levels of independence were compared with the organism that created Chondrites, a trace fossil that scientists have recorded near the red layer associated with the Chixulub crater in Mexico, generated by the impact of the meteorite that caused the Cretaceous-Tertiary extinction. Previous ichnological studies (on trace fossils) have shown that "the Chondrites-generating organism was able to inhabit the substrate immediately after the event, due to its opportunistic and independent nature," says Rodríguez-Tovar.

Using the data on trace fossils and on comparisons with present day disasters, the scientists were able to prove that "the community started to recover fairly rapidly following the mass extinction caused by the impact 65 million years ago, possibly within hundreds or thousands of years," concludes the palaeontologist.

Story Source:

Adapted from materials provided by FECYT - Spanish Foundation for Science and Technology, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Rodríguez-Tovar, F.J.; Martín-Peinado, F.J. **The environmental disaster of Aznalcollar (southern Spain) as an approach to the Cretaceous-Palaeogene mass extinction event**. *Geobiology*, 2009; 7 (5): 533-543

http://www.sciencedaily.com/releases/2010/02/100202101243.htm

Can Chocolate Lower Your Risk of Stroke?

A new analysis finds that eating chocolate may lower your risk of having a stroke. (Credit: iStockphoto/Emre Ogan)

ScienceDaily (Feb. 12, 2010) — Eating chocolate may lower your risk of having a stroke, according to an analysis of available research that was released February 11 and will be presented at the American Academy of Neurology's 62nd Annual Meeting in Toronto April 10 to April 17, 2010. Another study found that eating chocolate may lower the risk of death after suffering a stroke.

The analysis involved reviewing three studies on chocolate and stroke.

"More research is needed to determine whether chocolate truly lowers stroke risk, or whether healthier people are simply more likely to eat chocolate than others," said study author Sarah Sahib, BScCA, with McMaster University in Hamilton, Ontario, Canada. Sahib worked alongside Gustavo Saposnik, MD, MSc, where the study was completed at St. Michael's Hospital and the University of Toronto.

Chocolate is rich in antioxidants called flavonoids, which may have a protective effect against stroke, but more research is needed.

The first study found that 44,489 people who ate one serving of chocolate per week were 22 percent less likely to have a stroke than people who ate no chocolate. The second study found that 1,169 people who ate 50 grams of chocolate once a week were 46 percent less likely to die following a stroke than people who did not eat chocolate.

The researchers found only one additional relevant study in their search of all the available research. That study found no link between eating chocolate and risk of stroke or death.

Story Source:

Adapted from materials provided by American Academy of Neurology.

http://www.sciencedaily.com/releases/2010/02/100211163114.htm

How Brain Hears the Sound of Silence: Separate Brain Pathways Process the Start and End of What We Hear

Michael Wehr, professor of psychology and neuroscience at the University of Oregon, with undergraduate student researcher Xiang Gao, a co-author. (Credit: Michael McDermott)

ScienceDaily (Feb. 11, 2010) — A team of University of Oregon researchers have isolated an independent processing channel of synapses inside the brain's auditory cortex that deals specifically with shutting off sound processing at appropriate times. Such regulation is vital for hearing and for understanding speech.

The discovery, detailed in the Feb. 11 issue of the journal *Neuron,* goes against a long-held assumption that the signaling of a sound's appearance and its subsequent disappearance are both handled by the same pathway. The new finding, which supports an emerging theory that a separate set of synapses is responsible, could lead to new, distinctly targeted therapies such as improved hearing devices, said Michael Wehr, a professor of psychology and member of the UO Institute of Neuroscience.

"It looks like there is a whole separate channel that goes all the way from the ear up to the brain that is specialized to process sound offsets," Wehr said. The two channels finally come together in a brain region called the auditory cortex, situated in the temporal lobe.

To do the research, Wehr and two UO undergraduate students -- lead author Ben Scholl, now a graduate student at the Oregon Health and Science University in Portland, and Xiang Gao -- monitored the activity of neurons and their connecting synapses as rats were exposed to millisecond bursts of tones, looking at the responses to both the start and end of a sound. They tested varying lengths and frequencies of sounds in a series of experiments.

It became clear, the researchers found, that one set of synapses responded "very strongly at the onset of sounds," but a different set of synapses responded to the sudden disappearance of sounds. There was no overlap of the two responding sets, the researchers noted. The end of one sound did not affect the response to a new sound, thus reinforcing the idea of separate processing channels.

The UO team also noted that responses to the end of a sound involved different frequency tuning, duration and amplitude than those involved in processing the start of a sound, findings that agree with a trend cited in at least three other studies in the last decade.

"Being able to perceive when sound stops is very important for speech processing," Wehr said. "One of the really hard problems in speech is finding the boundaries between the different parts of words. It is really not well understood how the brain does that."

As an example, he noted the difficulty some people have when they are at a noisy cocktail party and are trying to follow one conversation amid competing background noises. "We think that we've discovered brain mechanisms that are important in finding the necessary boundaries between words that help to allow for successful speech recognition and hearing," he said.

The research -- funded in part by the UO's Robert and Beverly Lewis Center for Neuroimaging Fund -- aims to provide a general understanding of how areas of the brain function. The new findings, Wehr said, could also prove useful in working with children who have deficits in speech and learning, as well as in the design of hearing aids and cochlear implants. He also noted that people with dyslexia have problems defining the boundaries of sounds in speech, and tapping these processing areas in therapy could boost reading skills.

Story Source:

Adapted from materials provided by University of Oregon.

http://www.sciencedaily.com/releases/2010/02/100210124759.htm

Archaeological 'Time Machine' Greatly Improves Accuracy of Early Radiocarbon Dating

Professor Gerry McCormac and Dr Paula Reimer pictured in the 14 Chrono Centre at Queen's University Belfast. Staff at the Centre have been involved in the creation of a new calibration curve, which extends back 50,000 years. (Credit: Queen's University Belfast)

ScienceDaily (Feb. 11, 2010) — Researchers at Queen's University have helped produce a new archaeological tool which could answer key questions in human evolution.

The new calibration curve, which extends back 50,000 years, is a major landmark in radiocarbon dating -- the method used by archaeologists and geoscientists to establish the age of carbon-based materials.

It could help research issues including the effect of climate change on human adaption and migrations.

The curve called INTCAL09, has just been published in the journal *Radiocarbon*. It not only extends radiocarbon calibration but also considerably improves earlier parts of the curve.

Dr Ron Reimer of the Queen's School of Geography, Archaeology and Palaeoecology said: "The new radiocarbon calibration curve will be used worldwide by archaeologists and earth scientists to convert radiocarbon ages into a meaningful time scale comparable to historical dates or other estimates of calendar age.

"It is significant because this agreed calibration curve now extends over the entire normal range of radiocarbon dating, up to 50,000 years before today. Comparisons of the new curve to ice-core or other climate archives will provide information about changes in solar activity and ocean circulation."

It has taken nearly 30 years for researchers to produce a calibration curve this far back in time.

Since the early 1980s, an international working group called INTCAL has been working on the project.

The principle of radiocarbon dating is that plants and animals absorb trace amounts of radioactive carbon-14 from carbon dioxide in the atmosphere while they are alive but stop doing so when they die. The carbon-14 decays from archaeological and geological samples so the amount left in the sample gives an indication of how old the sample is.

As the amount of carbon -14 in the atmosphere is not constant, but varies with the strength of Earth's magnetic field, solar activity and ocean radiocarbon ages must be corrected with a calibration curve.

Most experts consider the technical limit of radiocarbon dating to be about 50,000 years, after which there is too little carbon-14 left to measure accurately with present day technology.

The project was led by Queen's University Belfast through a National Environment Research Centre (NERC) funded research grant to Dr Paula Reimer and Professor Gerry McCormac from the Centre for Climate, the Environment and Chronology (14CHRONO) at Queen's and statisticians at the University of Sheffield.

Ron Reimer and Professor Emeritus Mike Baillie from Queen's School of Geography, Archaeology and Palaeoecology also contributed to the work.

Story Source:

Adapted from materials provided by Queen's University Belfast.

http://www.sciencedaily.com/releases/2010/02/100211111549.htm

Electric Cars Are Going Places

Electric cars like the one above will be rolling through the Harz region in the future. The fleet of cars is supposed to be increased to twenty-five vehicles by June 2011. (Credit: Copyright Fraunhofer IFF/Dirk Mahler)

ScienceDaily (Feb. 11, 2010) — Electric cars have many merits: They are quieter and require less maintenance than cars with internal combustion engines. A network of smartly located charging stations covering the entire Harz region in Germany is bound to make electric cars a regional feature.

The Harz region is banking on electric cars. Electric cars will soon be rolling through Quedlinburg, Werningerode and other cities in the region. Seventeen partners from research, academia and industry have committed themselves to this with their project Harz.ErneuerbareEnergien-mobility or Harz.EE-mobility for short.

The success of electric cars will stand or fall with the power supply. The ability to charge vehicles with green power anytime and anywhere will boost acceptance of this technology. Hence, charging stations will have to be located astutely enough that electric cars will even be able to reach a city sixty kilometers away without any problem. Researchers at the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg are determining the optimal locations for charging stations.

"In addition to the flow of traffic, we are analyzing mobility characteristics to find out where vehicles are parked for how long. This time can be used to charge cars. Locations where vehicles may park long enough are favored for charging stations. Garages or parking lots at work or near one's residence are the preferred option," says Dr. Przemyslaw Komarnicki, Research Manager at the Fraunhofer IFF.

"We will also be making a decision about the number of charging stations. However, the results aren't in yet. The placement of charging stations must be carefully considered to keep the network from overloading."

The mobility control center where all the traffic and power data converge advises a driver to head for a suggested charging station based on the battery's charge level. Through the navigation system, the control center informs a driver which charging stations are occupied, being serviced or are closed and have low priced, renewable and/or sufficient electricity. When traffic is backed up, the control center guides cars with a low charge to a nearby charging station. Researchers at the Fraunhofer IFF are developing the necessary database system concept.

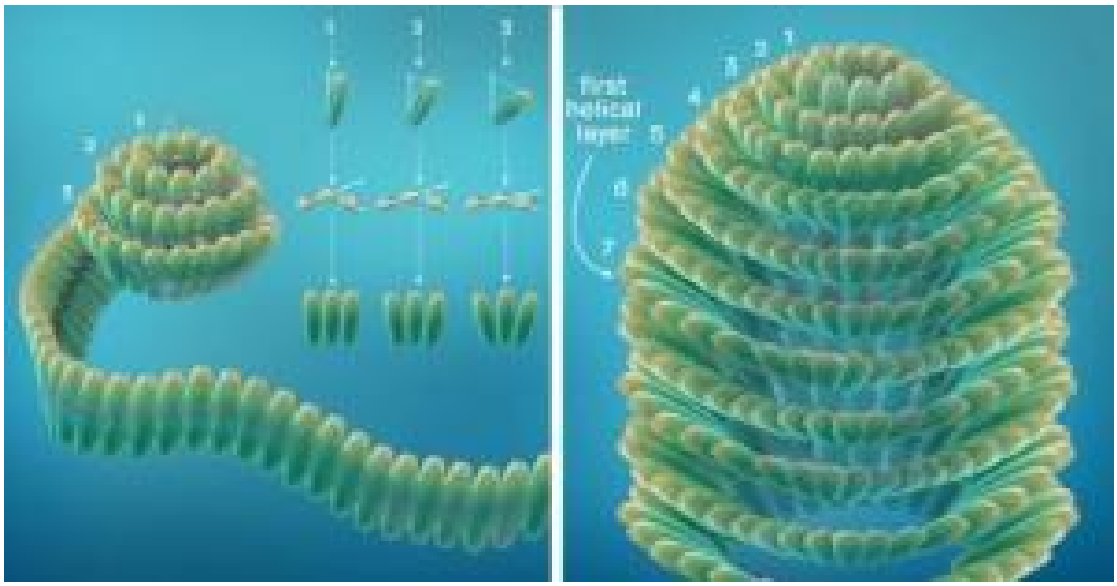
The Harz.EE-mobility project is being supported by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. The industry partners are providing part of the total funding of 12 million euros. The official test phase will begin at the end of 2010. 25 electric cars are intended to be underway in the Harz region by June 2011. First, they will be driven in cities in the Harz region. Later, they will also be made available to commuters who travel between Magdeburg and the Harz region.

Story Source:

Adapted from materials provided by Fraunhofer-Gesellschaft.

http://www.sciencedaily.com/releases/2010/02/100208144846.htm

3-D Structure of Bullet-Shaped Virus With Potential to Fight Cancer, HIV Revealed



Assembly of bullet-shaped VSV virion. (Credit: UCLA)

ScienceDaily (Feb. 11, 2010) — Vesicular stomatitis virus, or VSV, has long been a model system for studying and understanding the life cycle of negative-strand RNA viruses, which include viruses that cause influenza, measles and rabies.

More importantly, research has shown that VSV has the potential to be genetically modified to serve as an anti-cancer agent, exercising high selectivity in killing cancer cells while sparing healthy cells, and as a potent vaccine against HIV.

For such modifications to occur, however, scientists must have an accurate picture of the virus's structure. While three-dimensional structural information of VSV's characteristic bullet shape and its assembly process has been sought for decades, efforts have been hampered by technological and methodological limitations.

Now, researchers at UCLA's California NanoSystems Institute and the UCLA Department of Microbiology, Immunology and Molecular Genetics and colleagues have not only revealed the 3-D structure of the trunk section of VSV but have further deduced the architectural organization of the entire bullet-shaped virion through cryo-electron microscopy and an integrated use of image-processing methods.

Their research findings appear this month in the journal *Science*.

"Structures of individual rhabdovirus proteins have been reported in *Science* and other high-profile journals, but until now, how they are organized into a bullet shape has remained unclear," said study author Z. Hong Zhou, UCLA professor of microbiology, immunology and molecular genetics and a member of the CNSI. "The special shape of VSV-- a bullet head with a short, helical trunk-- has lent to its evasion from three-dimensional structural studies."

Based on their research into the structure of VSV, the team proposed a model for the assembly of the virus, with its origin at the bullet tip. Their data suggest that VSV assembles through the alternating use of several possible interaction interfaces coded in viral protein sequences to wind its protein and RNA chain into the characteristic bullet shape.

"Our structure provides the first direct visualization of the N and M proteins inside the VSV virion at 10.6-Å resolution. Surprisingly, our data clearly demonstrated that VSV is a highly ordered particle, with the nucleocapsid surrounded by, instead of surrounding, a matrix of M proteins," said lead study author Peng Ge, a visiting graduate student at UCLA from Baylor College of Medicine. "To our amusement, the sequence in assembling viral protein and RNA molecules into the virus appears to rhyme with the first several measures of Mozart's piano sonata in C-Major, K.545." (This musical correlation is illustrated in the paper's supplementary movie 2.)

The findings could help lead to advances in the development of VSV-based vaccines for HIV and other deadly viruses, according to the researchers.

"Our structure provides some of the first clues for understanding VSV-derived vaccine pseudotypes and for optimizing therapeutic VSV variants," Zhou said. "This work moves our understanding of the biology of this large and medically important class of viruses ahead in a dramatic way. The next stage of research for our team will be to reveal the details of molecular interactions at the atomic scale using advanced imaging instruments now available at CNSI."

The Electron Imaging Center for Nanomachines (EICN) lab at the CNSI has Cryo-EM instrumentation, including the Titan Krios microscope, which makes atomically precise 3-D computer reconstructions of biological samples and produces the highest-resolution images available of viruses, which may lead to better vaccines and new treatments for disease.

In addition to Z. Hong Zhou and Peng Ge, the research team included colleagues from the laboratory of Ming Luo, professor of microbiology at the University of Alabama at Birmingham, and Stan Schein, UCLA professor of psychology.

The research was supported by the National Institutes of Health.

Story Source:

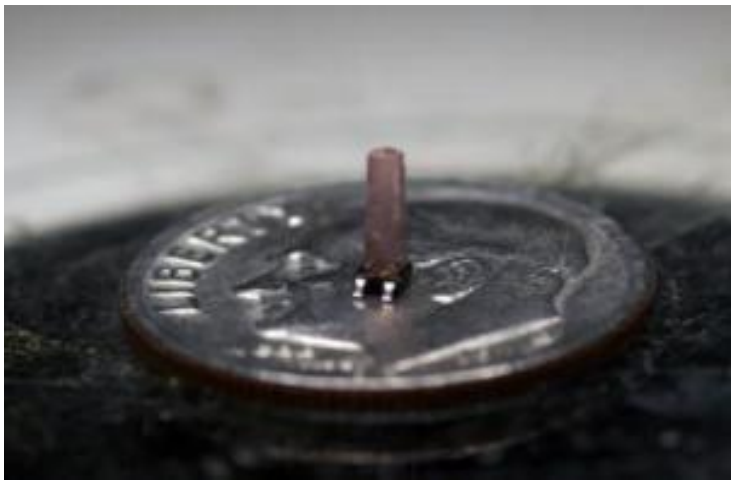
Adapted from materials provided by University of California - Los Angeles.

Journal Reference:

1. Peng Ge, Jun Tsao, Stan Schein, Todd J. Green, Ming Luo, and Z. Hong Zhou. **Cryo-EM Model of the Bullet-Shaped Vesicular Stomatitis Virus**. *Science*, 5 February 2010: Vol. 327. no. 5966, pp. 689 - 693 DOI: 10.1126/science.1181766

http://www.sciencedaily.com/releases/2010/02/100209111757.htm

New Magnetic Tuning Method Enhances Data Storage



A magnetic crystal sits on the head of a dime for scale. Scientists exploit the randomness of the magnetic field in the crystal at the molecular level to control the properties of the magnet as a whole. The chip underneath the crystal is a magnetic sensor. (Credit: University of Chicago)

ScienceDaily (Feb. 11, 2010) — Researchers in Chicago and London have developed a method for controlling the properties of magnets that could be used to improve the storage capacity of next-generation computer hard drives.

Magnets that can readily switch their polarity are widely used in the computer industry for data storage, but they present an engineering challenge: A magnet's polarity must be easily switched when writing data to memory, but be difficult to switch when storing or reading it.

These conflicting requirements are typically met by heating and softening the magnet for saving data, then cooling and hardening the magnet for storage and reading.

But now the University of Chicago's Daniel Silevitch and Thomas Rosenbaum and Gabriel Aeppli of the London Centre for Nanotechnology (a joint enterprise of University and Imperial Colleges London) have filed a patent on a method that avoids this complex heating operation.

As the trio report in the *Proceedings of the National Academy of Sciences*, they can tune the softness of the magnet with the application of a small external magnetic field, which allows writing, storage and readout at a fixed temperature.

Story Source:

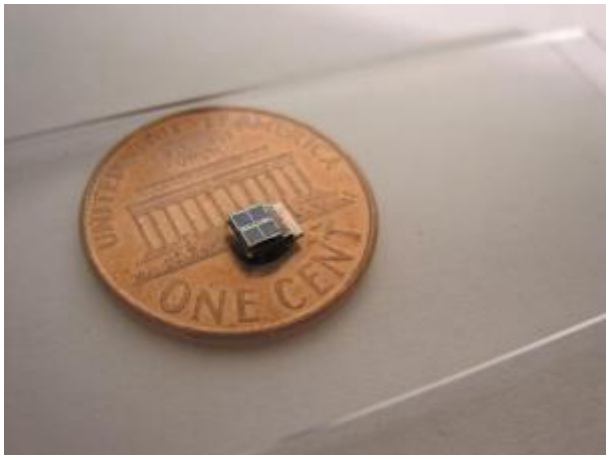
Adapted from materials provided by University of Chicago, via EurekAlert!, a service of AAAS.

Journal Reference:

1. D.M. Silevitch, G. Aeppli and T.F. Rosenbaum. **Switchable hardening of a ferromagnet at fixed temperature**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.0910575107

http://www.sciencedaily.com/releases/2010/02/100209111801.htm

Millimeter-Scale, Energy-Harvesting Sensor System Can Operate Nearly Perpetually



A low-power, sensor system developed at the University of Michigan 1,000 times smaller than comparable commercial counterparts. It could enable new biomedical implants. (Credit: Daeyeon Kim)

ScienceDaily (Feb. 11, 2010) — A 9 cubic millimeter solar-powered sensor system developed at the University of Michigan is the smallest that can harvest energy from its surroundings to operate nearly perpetually.

The U-M system's processor, solar cells, and battery are all contained in its tiny frame, which measures 2.5 by 3.5 by 1 millimeters. It is 1,000 times smaller than comparable commercial counterparts.

The system could enable new biomedical implants as well as home-, building- and bridge-monitoring devices. It could vastly improve the efficiency and cost of current environmental sensor networks designed to detect movement or track air and water quality.

With an industry-standard ARM Cortex-M3 processor, the system contains the lowest-powered commercial-class microcontroller. It uses about 2,000 times less power in sleep mode than its most energy-efficient counterpart on the market today.

The engineers say successful use of an ARM processor-- the industry's most popular 32-bit processor architecture-- is an important step toward commercial adoption of this technology.

Greg Chen, a computer science and engineering doctoral student, will present the research Feb. 9 at the International Solid-State Circuits Conference in San Francisco.

"Our system can run nearly perpetually if periodically exposed to reasonable lighting conditions, even indoors," said David Blaauw, an electrical and computer engineering professor. "Its only limiting factor is battery wear-out, but the battery would last many years."

"The ARM Cortex-M3 processor has been widely adopted throughout the microcontroller industry for its low-power, energy efficient features such as deep sleep mode and Wake-Up Interrupt Controller, which enables the core to be placed in ultra-low leakage mode, returning to fully active mode almost instantaneously," said Eric Schorn, vice president, marketing, processor division, ARM. "This implementation of the processor exploits all of those features to the maximum to achieve an ultra-low-power operation."

The sensor spends most of its time in sleep mode, waking briefly every few minutes to take measurements. Its total average power consumption is less than 1 nanowatt. A nanowatt is one-billionth of a watt.

The developers say the key innovation is their method for managing power. The processor only needs about half of a volt to operate, but its low-voltage, thin-film Cymbet battery puts out close to 4 volts. The voltage, which is essentially the pressure of the electric current, must be reduced for the system to function most efficiently.

"If we used traditional methods, the voltage conversion process would have consumed many times more power than the processor itself uses," said Dennis Sylvester, an associate professor in electrical and computer engineering.

One way the U-M engineers made the voltage conversion more efficient is by slowing the power management unit's clock when the processor's load is light.

"We skip beats if we determine the voltage is sufficiently stable," Sylvester said.

The designers are working with doctors on potential medical applications. The system could enable less-invasive ways to monitor pressure changes in the eyes, brain, and in tumors in patients with glaucoma, head trauma, or cancer. In the body, the sensor could conceivably harvest energy from movement or heat, rather than light, the engineers say.

The inventors are working to commercialize the technology through a company led by Scott Hanson, a research fellow in the Department of Electrical Engineering and Computer Science.

The paper is entitled "Millimeter-Scale Nearly Perpetual Sensor System with Stacked Battery and Solar Cells."

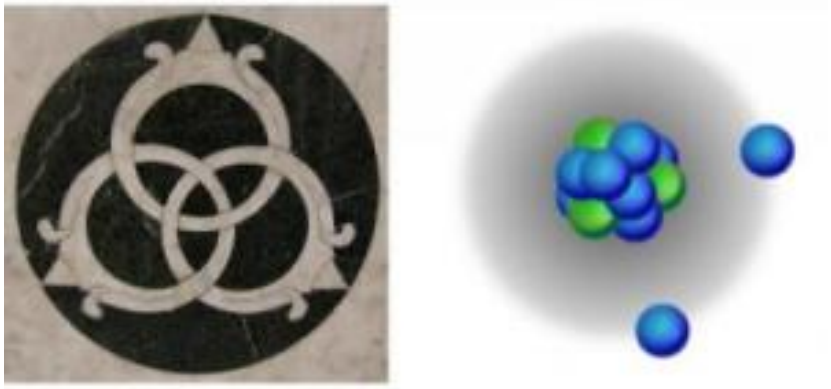
This research is funded by the National Science Foundation, the Defense Advanced Research Projects Agency, the National Institute of Standards and Technology, the Focus Center Research Program and ARM.

Story Source:

Adapted from materials provided by University of Michigan.

http://www.sciencedaily.com/releases/2010/02/100209111755.htm

Extra Large Carbon: Heaviest Halo Nucleus Discovered



Carbon-22 is now the heaviest observed Borromean nucleus. Borromean nuclei are named after the rings from the 15th century crest of the Borromeo family from Northern Italy. The rings are connected in such a way that the cutting of one ring results in the separation of all three. (Left) Marble representation of the Borromean rings, used as an emblem of Lorenzo de Medici in San Pancrazio, Florence. (Right) Schematic structure of 22C showing the two halo neutrons around a core. Removing any one element makes the entire structure unstable. (Credit: APS Physics)

ScienceDaily (Feb. 11, 2010) — An exotic form of carbon has been found to have an extra large nucleus, dwarfing even the nuclei of much heavier elements like copper and zinc, in experiments performed in a particle accelerator in Japan. The discovery is reported in the current issue of *Physical Review Letters* and highlighted with a Viewpoint by Kirby Kemper and Paul Cottle of Florida State University in the February 8 issue of *Physics*.

Carbon-22, which has a nucleus comprised of 16 neutrons and 6 protons, is the heaviest atom yet discovered to exhibit a "halo nucleus." In such atoms, some of the particles that normally reside inside the nucleus move into orbits outside the nucleus, forming a halo of subatomic particles. Because atoms like carbon-22 are packed with an excessive number of neutrons, they're unstable and rapidly break apart to form lighter atoms, but they are more stable than scientists had previously expected. The extra stability is a surprise because the three particles-- two neutrons and a nucleus-- that form a halo nucleus interact in a way that is difficult for physicists to model due to the complicated mathematics necessary to describe so-called "three body" problems.

The unexpected stability has led to such halo nucleus atoms being labeled Borromean atoms in reference to an ancient pattern depicting three rings interlocked such that the removal of any one ring would cause all three to be disconnected. Borromean rings were often used to symbolize a stable union of three parts in traditional carvings and family crests.

The detection and analysis of carbon-22 sets a new milestone in challenging nuclear physics, and hails a promising era in the investigation of heavier and even more exotic nuclei as new beam facilities and more sensitive detectors come on line over the next decade. The surprising discovery of carbon-22's halo suggests that nuclear physicists will have plenty of new ground to cover in coming years.

Story Source:

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

http://www.sciencedaily.com/releases/2010/02/100209182405.htm

Selective Brain Damage Modulates Human Spirituality, Research Reveals

A new study explores the neural basis of spirituality by studying patients before and after surgery to remove a brain tumor. (Credit: iStockphoto/Henrik Jonsson)

ScienceDaily (Feb. 11, 2010) — New research provides fascinating insight into brain changes that might underlie alterations in spiritual and religious attitudes. The study, published by Cell Press in the February 11 issue of the journal *Neuron*, explores the neural basis of spirituality by studying patients before and after surgery to remove a brain tumor.

Although it is well established that all behaviors and experiences, spiritual or otherwise, must originate in the brain, true empirical exploration of the neural underpinnings of spirituality has been challenging. However, recent advances in neuroscience have started to make the complex mental processes associated with religion and spirituality more accessible.

"Neuroimaging studies have linked activity within a large network in the brain that connects the frontal, parietal, and temporal cortexes with spiritual experiences, but information on the causative link between such a network and spirituality is lacking," explains lead study author, Dr. Cosimo Urgesi from the University of Udine in Italy.

Dr. Urgesi and colleagues were interested in making a direct link between brain activity and spirituality. They focused specifically on the personality trait called self-transcendence (ST), which is thought to be a measure of spiritual feeling, thinking, and behaviors in humans. ST reflects a decreased sense of self and an ability to identify one's self as an integral part of the universe as a whole.

The researchers combined analysis of ST scores obtained from brain tumor patients before and after they had surgery to remove their tumor, with advanced techniques for mapping the exact location of the brain lesions after surgery. "This approach allowed us to explore the possible changes of ST induced by specific brain lesions and the causative role played by frontal, temporal, and parietal structures in supporting interindividual differences in ST," says researcher Dr. Franco Fabbro from the University of Udine.

The group found that selective damage to the left and right posterior parietal regions induced a specific increase in ST. "Our symptom-lesion mapping study is the first demonstration of a causative link between

brain functioning and ST," offers Dr. Urgesi. "Damage to posterior parietal areas induced unusually fast changes of a stable personality dimension related to transcendental self-referential awareness. Thus, dysfunctional parietal neural activity may underpin altered spiritual and religious attitudes and behaviors."

These results may even lead to new strategies for treating some forms of mental illness. "If a stable personality trait like ST can undergo fast changes as a consequence of brain lesions, it would indicate that at least some personality dimensions may be modified by influencing neural activity in specific areas," suggests Dr. Salvatore M. Aglioti from Sapienza University of Rome. "Perhaps novel approaches aimed at modulating neural activity might ultimately pave the way to new treatments of personality disorders."

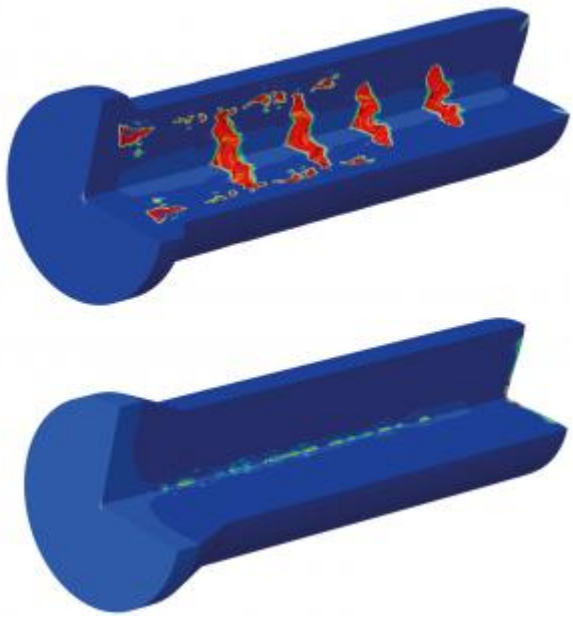
The researchers include Cosimo Urgesi, Universita` di Udine, Udine, Italy, Istituto di Ricovero e Cura a Carattere Scientifico Eugenio Medea, Pordenone, Italy; Salvatore M. Aglioti, Sapienza Universita` di Roma, Roma, Italy, Istituto di Ricovero e Cura a Carattere Scientifico Fondazione S. Lucia, Roma, Italy; Miran Skrap, Azienda Ospedaliero-Universitaria Santa Maria della Misericordia, Udine, Italy; and Franco Fabbro, Universita` di Udine, Udine, Italy, Istituto di Ricovero e Cura a Carattere Scientifico Eugenio Medea, Pordenone, Italy.

Story Source:

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

http://www.sciencedaily.com/releases/2010/02/100210124757.htm

Perfectly Shaped Solid Components



The simulation shows the results of cold forging. An optimized tool geometry (bottom) keeps pore density low. (Credit: Copyright Fraunhofer IWM)

ScienceDaily (Feb. 11, 2010) — When metals are shaped, the materials they are made of are often damaged in the process. One cause of this is excessive press force, which cracks and perforates the material. By running simulations on a PC, research scientists can now calculate how to avoid component defects.

There are plenty of shiny new automobiles to see at the auto trade show. Over there stands a Porsche covered in gold leaf, and on the other side a Bordeaux-red Mercedes is presented. But behind all the glitz and glamour, the process involved in producing these luxury cars is long and arduous.

The properties of the materials used are complex and a number of complications can arise during manufacture. The steel fabricators at the front end of the production chain have to negotiate the first hurdle. They shape solid pieces of metal to make sheets, tubes, rods and bars, which the car manufacturers then process further. In the shaping process the materials can suffer damage if they are excessively deformed, because the friction is too high or the temperature of the forming tool is not exactly right.

To produce a defect-free component, the manufacturers not only have to make numerous prototypes with the right material properties, but also work out by trial and error how the forming tool needs to be set. This is time-consuming and expensive.

The research scientists at the Fraunhofer Institute for Mechanics of Materials IWM in Freiburg have succeeded in reducing the cost of this process with the aid of computerized models. "With our numerical simulation we can calculate how much deformation a component can withstand before cracking. And we can analyze the effect of factors such as press force and lubricants on the properties of the material," explains Dr. Dirk Helm, project manager at the IWM. The commercial software currently available cannot predict the deformation behavior of solid metal components in as much detail as his simulation routines.

Helm: "We found that by making a specific change to the geometry of a shaping tool unwanted perforations were avoided because the pore density did not rise sharply but only slightly. With our

simulation we can identify the optimal properties of components and shaping tools much more quickly than by trial and error."

The research scientist is convinced that these simulations will considerably reduce the amount of waste material.

The software has already proved itself in actual practice. So far the experts have used their numerical simulation in cold-shaping processes in which the temperature of a tool is not a factor. In future the computer simulation will also be used for hot shaping.

Story Source:

Adapted from materials provided by Fraunhofer-Gesellschaft.

http://www.sciencedaily.com/releases/2010/02/100208144850.htm

Scientists Discover Origin of HIV Transmission Among Male Partners

Davey Smith, M.D., M.A.S. (Credit: UC San Diego School of Medicine)

ScienceDaily (Feb. 11, 2010) — A team of scientists, led by a virologist from the University of California, San Diego's Center for AID Research (CFAR), has discovered the origin of strains of human immunodeficiency virus (HIV) among men who have sex with men. The study, which may be important in developing prevention strategies for HIV, will appear in *Science Translational Medicine* on February 10, 2010.

"If we want to stop the HIV epidemic, then we must know the mechanisms by which HIV uses human sex to spread," said principal investigator Davey Smith, MD, MAS, associate professor of medicine in UCSD's Division of Infectious Diseases and in the Veterans Affairs San Diego Healthcare System, and director of the CFAR Viral Pathogenesis Core.

It is known that most HIV infections worldwide result from exposure to the HIV virus in semen, made up of seminal cells and the fluid around these calls, called seminal plasma. HIV virus particles contain RNA and exist in the plasma, while infected seminal cells contain HIV DNA.

Using a method of comparing genetic characteristics, called phylogenetic analysis, the researchers studied a group of men who had sexually transmitted their HIV virus to other men. Phylogenetic models allow researchers to estimate the dates of origin of various groups of viruses; in this way the team was able to determine the source of rapidly mutating HIV viruses by analyzing the viral sequences extracted from the blood and semen of HIV transmitting partners. The team found that recipients shared a more recent common ancestor with virus from the seminal plasma than with virus found in the seminal cells of their source partner.

"Until now, it had not been established whether HIV RNA or DNA is transmitted during sex," said Smith. "By analyzing the genetic differences between these two forms and the virus that was ultimately transmitted to newly infected individuals we found that it was the HIV RNA form present in seminal plasma that was transmitted."

"The findings from this study will help direct prevention strategies to address the virus in the seminal plasma," Smith said. "By knowing the origin of the transmitted virus, scientists may be able to develop new vaccines, vaginal microbicides and drugs to prevent the spread of sexually transmitted HIV."

Smith notes that because the study involved pairs of men who have sex with men, the findings do not comment directly on HIV transmission to women. "Since the vast majority of women are infected with HIV by exposure to the virus in semen, HIV RNA in the seminal plasma is the likely culprit, but this needs to be confirmed," he said.

Additional authors include David M. Butler, Wayne Delport, Sergei L. Kosakovsky Pond, Malcolm K. Lakdawala, Pok Man Cheng and Susan J. Little, UCSD Department of Medicine; and Douglas D. Richman, UCSD Department of Medicine and Veterans Affairs San Diego Health System.

The study was funded in part by the National Institutes of Health and the National Science Foundation.

Story Source:

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

http://www.sciencedaily.com/releases/2010/02/100210141649.htm

Do-It-Yourself Genetic Engineering
By JON MOOALLEM

IT ALL STARTED with a brawny, tattooed building contractor with a passion for exotic animals. He was taking biology classes at City College of San Francisco, a two-year community college, and when students started meeting informally early last year to think up a project for a coming science competition, he told them that he thought it would be cool if they re-engineered cells from electric eels into a source of alternative energy. Eventually the students scaled down that idea into something more feasible, though you would be forgiven if it still sounded like science fiction to you: they would build an electrical battery powered by bacteria. This also entailed building the bacteria itself — redesigning a living organism, using the tools of a radical new realm of genetic engineering called synthetic biology.

A City College team worked on the project all summer. Then in October, five students flew to Cambridge, Mass., to present it at M.I.T. and compete against more than 1,000 other students from 100 schools, including many top-flight institutions like Stanford and Harvard. City College offers courses in everything from linear algebra to an introduction to chairside assisting (for aspiring dental hygienists), all for an affordable $26 a credit. Its students were extreme but unrelenting underdogs in the annual weekend-long synthetic-biology showdown. The competition is called iGEM: International Genetically Engineered Machine Competition.

The team's faculty adviser, Dirk VandePol, went to City College as a teenager. He is 41, with glasses, hair that flops over his forehead and, frequently, the body language of a man who knows he has left something important somewhere but can't remember where or what. While the advisers to some iGEM teams rank among synthetic biology's leading researchers, VandePol doesn't even teach genetic engineering. He teaches introductory human biology — "the skeletal system and stuff," he explained — and signed on to the team for the same reason that his students did: the promise of this burgeoning field thrills him, and he wanted a chance to be a part of it. "Synthetic biology is the coolest thing in the universe," VandePol told me, with complete earnestness, when I visited the team last summer.

The first thing to understand about the new science of synthetic biology is that it's not really a new science; it's a brazen call to conduct an existing one much more ambitiously. For almost 40 years, genetic engineers have been decoding DNA and transplanting individual genes from one organism into another. (One company, for example, famously experimented with putting a gene from an arctic flounder into tomatoes to make a variety of frost-resistant tomatoes.) But synthetic biologists want to break out of this cut-and-paste paradigm altogether. They want to write brand-new genetic code, pulling together specific

genes or portions of genes plucked from a wide range of organisms — or even constructed from scratch in a lab — and methodically lacing them into a single set of genetic instructions. Implant that new code into an organism, and you should be able to make its cells do and produce things that nothing in nature has ever done or produced before.

As commercial applications for this kind of science materialize and venture capitalists cut checks, the hope is that synthetic biologists can engineer new, living tools to address our most pressing problems. Already, for example, one of the field's leading start-ups, a Bay Area company called LS9, has remade the inner workings of a sugar-eating bacterium so that its cells secrete a chemical compound that is almost identical to diesel fuel. The company calls it a "renewable petroleum." Another firm, Amyris Biotechnologies, has similarly tricked out yeast to produce an antimalarial drug. (LS9, backed by Chevron, aims to bring its product to market in the next couple of years. Amyris's drug could be available by the end of this year, through a partnership with Sanofi-Aventis.) Stephen Davies, a synthetic biologist and venture capitalist who served as a judge at iGEM, compares the buzz around the field to the advent of steam power during the Victorian era. "Right now," he says, "synthetic biology feels like it might be able to power everything. People are trying things; kettles are exploding. Everyone's attempting magic right and left."

Genetic engineers have looked at nature as a set of finished products to tweak and improve — a tomato that could be made into a slightly better tomato. But synthetic biologists imagine nature as a manufacturing platform: all living things are just crates of genetic cogs; we should be able to spill all those cogs out on the floor and rig them into whatever new machinery we want. It's a jarring shift, making the ways humankind has changed nature until now seem superficial. If you want to build a bookcase, you can find a nice tree, chop it down, mill it, sand the wood and hammer in some nails. "Or," says Drew Endy, an iGEM founder and one of synthetic biology's foremost visionaries, "you could program the DNA in the tree so that it grows into a bookshelf."

Endy is part of a group of synthetic biologists that is focused on building up basic tools to make this process faster, cheaper and less research intensive, so that even the most sophisticated custom-built life forms can be assembled from a catalog of standardized parts: namely, connectable pieces of DNA called BioBrick parts, which snap together like Legos. Ideally you wouldn't even need to know anything about DNA to manipulate it, just as a 5-year-old doesn't need to understand the chemical composition of the plastic in his Legos to build a fortress on the living-room carpet.

With the field still in its infancy, and with such monstrously ambitious work ahead of it, you never really hear the word "failure" at iGEM. Some teams do manage genuine breakthroughs. (One of the most successful teams in 2009, drawn from two universities in Valencia, Spain, engineered a synthetic yeast that lights up in response to electricity, with which they might construct a computer screen made of yeast cells instead of digital pixels — a living LCD.) But students aren't necessarily expected to build a perfectly functioning living machine in one summer. More important at this stage are the tools and the techniques they generate in the process of trying.

Over the past five years, iGEM teams have been collaboratively amassing a centralized, open-source genetic library of more than 5,000 BioBricks, called the Registry of Standard Biological Parts. Each year teams use these pieces of DNA to build their projects and also contribute new BioBricks as needed. BioBricks in the registry range from those that kill cells to one that makes cells smell like bananas. The composition and function of each DNA fragment is cataloged in an online wiki, which iGEM's director calls "the Williams-Sonoma catalog of synthetic biology." Copies of the actual DNA are stored in a freezer at M.I.T., and BioBricks are mailed to teams as red smudges of dehydrated DNA. Endy showed me a set stuck to paper, like candy dots.

Still, the real legacy of iGEM may end up being the future synthetic biologists it is inspiring. There was an irrepressibly playful atmosphere around the weekend-long iGEM Jamboree at M.I.T. — students strode around in team T-shirts or dressed up as bacterial mascots — and each year the winning team flies home with the BioBrick grand-prize trophy, a large aluminum Lego, which is passed from champion to

champion like the Stanley Cup. IGEM has been grooming an entire generation of the world's brightest scientific minds to embrace synthetic biology's vision — without anyone really noticing, before the public debates and regulations that typically place checks on such risky and ethically controversial new technologies have even started.

City College, the first two-year college to enter a team at iGEM, is not the place to go if you want to see synthetic biology's cutting edge. But it turns out to be an ideal place to understand the can-do fervor propelling the science forward. The question was never whether Team City College would win this year's iGEM. It would absolutely not win. The question was how it managed to get there at all.

Of all the City College students, Colby Sandate seemed the most enthralled with synthetic biology; he often drove around the Bay Area to attend talks by its leading researchers and provocateurs or to visit start-ups. He hoped to make a career in the field, he told me, and felt lucky to be a part of the generation that would get in on its ground floor. "It's a chance to be part of something bigger than ourselves," he said. "A real modern scientific movement."

Sandate, who is 21, is half indigenous Mexican, half Italian. He was working 20 hours a week selling Kiehl's skin-care products to women in upscale Pacific Heights, but even so he emerged as the de facto leader of the City College team, shouldering a lot of the bureaucratic responsibilities and always projecting a low-key confidence in the lab. "His temperament is just indestructible," VandePol told me one morning.

It was the first week in September, and the team was reconvening after a two-week break. City College closed its building for most of August, exiling the members of the synthetic-biology team from the unoccupied basement classroom they had commandeered as a lab (the school is not a research institution — there are no real laboratories). The school had been facing escalating financial trouble all year, and now with the fall semester starting and classrooms filling up, all it could offer the team members was a run-down greenhouse on the top floor of the science building. It was filled with plants, flies and compost tubs and smelled of mildew and loam: not the sterile environment their work required. So they began squatting in whatever classroom happened to be open on a given day, wheeling their materials around the halls on carts.

Teams at most schools pay students to work on their projects; some have budgets as high as $90,000. At the iGEM Jamboree, the backs of some team shirts overflowed, Nascarlike, with their sponsors' logos, including those of a few multinationals like Monsanto and Merck. The City College team had rustled up a budget of $18,000. (A school administrator knew someone who knew the widow of a Berkeley scientist and Levi-Strauss heir.) Almost everything the team had was either donated or borrowed. An educational nonprofit lent it some equipment, and the students took frequent trips to a depot an hour south, where biotech start-ups ditch their old glassware. There were no stipends, and the students were balancing their work on the battery with jobs and their regular coursework. It made for an unpredictable, rotating cast.

But by early fall the core group that would travel to M.I.T. established itself. In addition to Sandate, there was the team's founder, Leeza Sergeeva, a deadpan 19-year-old from Moscow; Angela Brock, 34, with a bleached, punk haircut, who came back to school to study electrical engineering after dropping out 10 years ago; and Bertram Lee, 47, a high-spirited man who wore his pants high on the waist and short at the ankles. Lee spent a decade designing databases in the financial sector, then took up science somewhat spontaneously after his parents passed away. Finally there was Bowen Hunter, a plucky 27-year-old certified massage therapist who went to a Southern Baptist high school in Texas that taught creationism instead of evolution and now wanted to get a master's and teach in City College's biotech track.

From a technical standpoint, the design of the team's battery was relatively straightforward compared with other iGEM projects, but it turned out to be ambitious in its own way. Two glass containers, the size of cider jugs, would be connected by a glass tube. Each contained a different species of bacteria, living in a liquid medium. The bacteria on the right side, R. Palustris, are photosynthetic, converting sunlight into sugar, which they need to survive. The other bacteria also subsist on sugar but can't generate their own;

they use sugar as energy to create a small electric charge. Both types of bacteria exist, as is, in nature; the team spent a lot of time researching online for the best-suited species and ones they could easily obtain. VandePol fetched a particularly good strain of R. Palustris from a lab at M.I.T. when he flew there for an iGEM teachers' training last spring, and the team bought the other bacteria, first discovered at the bottom of a bay in Virginia, for $240 through the mail.

The idea was to build a bacteria-based battery that could be powered entirely by the sun. To do that, the team would redesign the photosynthetic R. Palustris so that it released some of the sugar it made and sent it through the tube to fuel the electricity generation of the bacteria on the other side. The students would need to re-engineer R. Palustris to give up its food — something that in nature would be totally nonsensical. They had a long list of tasks, but this was the pivotal one: give R. Palustris a leak.

The story of iGEM and, to some degree, the vision of synthetic biology that it champions, begins not with biologists but with engineers. From the beginning, the approach was rooted less in the biologist's methods of patient observation than in the engineer's childlike love of building cool stuff and hyperrational expectations about the way things ought to work.

Drew Endy came to M.I.T. as a bioengineering fellow in 2002 at the age of 32. He now teaches at Stanford and is probably the field's most voluble and charismatic spokesman. "I sort of Facebook-stalk him," I overheard a student say at the jamboree. (Last month, the National Science Foundation financed the creation of a full-scale BioBrick part factory in the Bay Area, called the Biofab; Endy is a founding director.) At M.I.T., Endy found a group of colleagues — like him, all originally engineers by training — who were disappointed with how unmethodical a field that was termed "genetic engineering" appeared to still be: its major successes were more like imaginative, one-off works of art than systematic engineering projects. As Endy told me, "I grew up in a world where you can go into a hardware store and buy nuts and bolts, put them together and they work." Just as you tell a computer to add 2 and 2 and know you'll get 4, Endy said, you should be able to give a cell simple commands and have it reliably execute them — and explaining this, he still managed to sound honestly flummoxed that something so absolutely logical wasn't actually true; his approach to the living world is astonishingly Spock-like. "Biology is the most interesting and powerful technology platform anyone's ever seen," he said. "It's already taken over the world with reproducing machines. You can kind of imagine that you should be able to program it with DNA."

Arguably this has been an implicit dream of genetic engineering all along. But starting in the mid-'90s, synthetic biologists concluded that we had amassed enough knowledge about how genomes work and developed enough tools for manipulating them that it was time to actively pursue it. In 2003, Endy formed a partnership with three other like-minded engineers at M.I.T., Gerald Sussman, Randy Rettberg and Tom Knight. Rettberg, who now directs iGEM, had absolutely no background in biology until, after retiring as a chief technology officer at Sun Microsystems in 2001, he started reading textbooks and hanging around Knight's lab; the two friends worked early in their careers on designing computers. Knight had already developed the concept of BioBrick parts and a method for connecting them.

The four men decided that rather than spend decades figuring out how to turn life into the predictable machinery they wanted it to be and then teaching that to their students, they would enlist the students to help. They taught a monthlong course challenging teams of students to design E. coli that "blinked" — that is, generated fluorescent light at regular intervals. That first experimental class rapidly evolved, by 2006, into an iGEM Jamboree involving 35 schools. And from there, Endy told me, "this thing goes international fast."

It's easy to understand what makes synthetic biology alluring to undergrads. For biology students, iGEM is a chance to creatively design the kind of powerful biological systems inside organisms they've spent so many years studying. For engineers, it's a chance to work with the most awesome material around: life. It's also a rare opportunity for students to direct their own research. Experiments done for science classes are usually predetermined to work. Here, as Bowen Hunter put it, "You're not just following instructions; you're paving a way." Consequently, many schools' iGEM teams are initiated by students, almost as

extracurricular clubs for the summer, not by professors or provosts. Endy told me, "We have now, in a bottom-up, grass-roots fashion, de facto installed a genetic-engineering curriculum for the future of our field in 120 schools worldwide."

By now, many schools have taken a proactive approach, developing "iGEM boot camp" courses and smaller, intramural iGEM jamborees in advance of the competition. A public high school in San Francisco teams seniors with mentors from the University of California, San Francisco to compete. "I've just never seen an idea that galvanizes the excitement of young students as much as this," says Wendell Lim, the team's adviser. At Imperial College London, strong showings at the iGEM Jamboree have contributed to the growth of a full-fledged synthetic-biology institute. Or consider the case of the Slovenian iGEM team, the most intimidating squad coming into last fall's jamboree and also the hardest to miss, having forgone mere team T-shirts for severe, blue athletic jerseys that made the dozen young Slovenians seem capable of sprinting 200 meters or throwing a discus at a moment's notice. "I think the last two years, we have 100 percent, beyond doubt, the best shirts," the team's adviser, Roman Jerala, told me.

Slovenia had won the BioBrick trophy in two of the past three iGEMs, including the previous fall, when it produced a possible vaccine for a bacteria that causes stomach ulcers, presenting promising data in mice. The team is covered consistently by the Slovenian media, and Jerala had recently lectured about synthetic biology to the Slovenian National Assembly. A television network named him one of Slovenia's seven most influential people.

The students at City College splurged. One day last summer, they ordered a brand-new $600 voltage meter, so that if they got the battery up and running, they could measure the electricity it generated. Their prototype might only light an LED, but by scaling up the two chambers of bacteria you could, in theory, build a credible tool for solving the world's energy crisis — at lower cost than conventional solar panels. Sergeeva envisioned a smaller version to power space probes.

The voltage meter was the team's only piece of new equipment, and its arrival one day last September was stirring. Though the team was woefully behind schedule, morale was high, and VandePol clearly wanted to keep it that way. "Isn't this a little honey?" he said, slipping the yellow machine out of its box. "Let's measure the voltage of something!"

He had Sandate hold the meter's leads in each hand. Then he grabbed the lid of the Styrofoam cooler in which they kept their vials of DNA and started rubbing it against Sandate's sweater, trying to get some static going. The meter didn't move. Sandate looked at the soles of his sneakers. "Maybe if I'm not grounded," he said. He stood on a chair. VandePol kept rubbing. Still nothing.

This was about how things were going for Team City College. Across the room, Bowen Hunter was, as usual, toiling away in front of the P.C.R. machine, a desktop appliance that looked like some 1970s conception of a futuristic food processor. P.C.R., or polymerase chain reaction, has been a key tool in genetic engineering since the late 1980s — a way to copy, rearrange or stitch together particular sequences of DNA by alternately heating and cooling the DNA to break and reform its chemical bonds. Hunter was carefully pipetting various fragments of other DNA, called primers, into the top of the machine. The team had been painstakingly experimenting with the right combinations of primers, as if perfecting a recipe, to copy a particular gene. Hunter had to add the contents of more than 100 different pipettes before she could run the machine, initiating a number of various reactions, and she sat there in her lab coat and goggles for hours, ripping open sterile pipette tips, chucking each used one into a plastic hazmat bin in front of her.

The team had done some more research and discovered that there are species of bacteria that already have holes in their cell membranes through which sugar passes; those bacteria all use the holes to let food in, but they could, theoretically, be made to do the reverse. It was exactly the design feature that Team City College needed to give its R. Palustris. They had already made multiple attempts to first pull that

particular gene out of one bacterium and tweak it in a specific way to turn it into an easily connectable BioBrick part. Then they would try to insert that into R. Palustris.

Most iGEM teams' designs involve many more manipulations of DNA; some teams create a dozen new BioBricks during the summer, but this hole-maker would be City College's sole contribution to the registry. Even if the battery never worked, another synthetic biologist, 50 years from now, might stumble upon this custom-made part, take it off the shelf and put it to a totally different use in an organism he or she was designing. That is, if the City College students ever managed to actually create the BioBrick. If they didn't design the primers correctly, a reaction would fail. If Hunter's arm wasn't totally steady as she deposited those chemicals into the machine, a reaction would fail. If flecks of her skin or her hair — or any other stray DNA in the room, for that matter — fell into the machine, a reaction would fail. And reactions were failing — again and again, for most of August and into the fall.

This work is not nearly as big a stumbling block for more typical iGEM teams. In fact, some better-financed teams outsource the job to professional gene-synthesis companies with superior, industrial-scale equipment. The cost of synthesizing genes has dropped tremendously in the last five years. (DNA is essentially an intricate chain of four different chemical compounds, each represented by a letter; a gene can be thousands of letters long. You can now send a sequence of those letters to companies like Blue Heron Biotechnology, outside Seattle, and get the actual gene back in the mail for a dollar, or less, per letter.) Across the bay from City College, a University of California, Berkeley iGEM team was building a piece of computer software that allowed it to design genetic parts by dragging and dropping DNA sequences together on the screen. Then, with the click of a button, the software fed instructions to a liquid-handling robot in their lab that executed various reactions and assembled each genetic part they needed. It was like when you line up songs on iTunes and burn the playlist on a CD. "We're making way more DNA's than we ever have before, and we couldn't have done it without the robot," the Berkeley team's adviser told me.

City College didn't have a robot. They had Hunter. And what astounded me as I continued to visit the team was how persistent she and everyone else remained despite the fact that — by any objective measure — their battery remained a failure. With only a few weeks to go, at 4 o'clock on a sunny Friday afternoon, the week before midterms, I found them pounding away at all dimensions of the project. Hunter was now working with the P.C.R. machine for hours at a time in a storage closet, the only space she could consistently find available.

Even if the battery wasn't working, iGEM itself was. With the limits of what's possible still totally unclear in synthetic biology, what the field may need most of all — what will move it forward faster — is a global mob of young people slogging away in their labs to construct stuff plucked from the edges of their imaginations. A new field needs failures to analyze and successes to build on. Moreover, if the goal is to make life easier to manipulate — requiring less time, money and, ultimately, expertise — "the fact that a community college can participate," Drew Endy noted, "is a sign that we are succeeding."

The rise of synthetic biology only intensifies ethical and environmental concerns raised by earlier forms of genetic engineering, many of which remain unsettled. Given synthetic biology's open-source ethic, critics cite the possibility of bioterror: the malicious use of DNA sequences posted on the Internet to engineer a new virus or more devastating biological weapons. ETC Group, an international watchdog that has raised complicated questions about synthetic biology since its earliest days, also warns of the potential for "bio-error": what unintended and unimaginable consequences might result from deploying all these freely reproducing, totally novel organisms into the world? What if those living machines don't work exactly as planned? "In a way, you don't have to have a working product to sell it," says Jim Thomas, a senior researcher at ETC Group. "You just have to have a product that seems to work long enough to get into the open market." And, Thomas adds, as corporations continue to invest in organisms that turn biomass into fuel or plastics, otherwise unlucrative crops will suddenly be commoditized as feedstock for those synthetic organisms — requiring more land to be cultivated and potentially displacing food crops or people.

"This absolutely requires a public and political discussion," Thomas told me. "It's going to change the alignments between very large corporations. It's going to change the ownership and patenting of life forms. The field is growing at such a speed and industrial money is flowing into it at such a speed — and here you have very excited, smart, clever young people becoming wedded to these techniques. The worry is, there's not a lot of space left for reflection."

Most students I met at iGEM said they were attracted to synthetic biology because of the immense good it might accomplish and had spent their summers engineering very altruistic microbes: ones that generate cheap alternative energy, attack tumors or deliver pharmaceuticals within the body, detect fertilizer runoff in drinking water, reveal the location of land mines or, in the case of Stanford's team, wipe out irritable-bowel syndrome. iGEM has begun to require students to consider any ethical or safety questions their projects raise, and Endy seems particularly intent on making sure that these issues, as they pertain to the field in general, are discussed publicly.

Still, the spirit of the competition is geared toward exuberance, not introspection. At the closing ceremonies, iGEM's director, Randy Rettberg, told everyone that he was counting on them to "spread synthetic biology everywhere." He invoked, as he does constantly, his role in pioneering the Internet 40 years ago and explained, "I think that over the next 40 years synthetic biology will grow in a similar way and become at least as important as the Internet is now and that you will be the leaders, that you will form the companies, that you will own the private jets and that you will invite me for rides."

After Rettberg's speech, the 2009 BioBrick trophy was ceremoniously awarded to the Cambridge University team, developer of "E. Chromi": E. coli that is programmable to turn one of five colors when it detects a certain concentration of an environmental toxin. After the announcement, the Cambridge squad strode out onto the lawn in front of the auditorium, formed a human pyramid and posed for photos around the big silver Lego.

Team City College stood a few yards behind them with understated pride, reveling in the intellectual contact high and collegiality of the entire weekend — even though, in the end, the team never managed to produce a functioning BioBrick for the registry and was thus disqualified for the most basic form of commendation, an iGEM bronze medal. "That was sad," one judge, a Harvard Ph.D. candidate named Christina Agapakis, later told me. "I really wanted to give them a medal. They were so excited and so motivated despite all the challenges they faced. I really liked them. I was definitely rooting for them as underdogs."

In fact, the students from City College heard this from people, spontaneously, throughout the weekend: as one man who approached Colby Sandate put it, they embodied the audacity and the grit that iGEM is supposed to be about. The competition, after all, is itself a machine, engineered to absorb enthusiastic young people and produce synthetic biologists. "I was like, 'Really?' " Sandate told me. "Nobody's ever complimented us that much before." He had chosen to genuinely embrace Team City College's status as the Bad News Bears of synthetic biology. Like the head of a small start-up, he was already lining up equipment, lab space and seed money for the next year.

Jon Mooallem is a contributing writer for the magazine.

This article has been revised to reflect the following correction:

Correction: February 14, 2010
An article on Page 40 this weekend about synthetic biology misstates the cause of stomach ulcers for which a possible vaccine is being produced by a team of Slovenian students. The vaccine would treat ulcers caused by bacteria, not by a virus.

http://www.nytimes.com/2010/02/14/magazine/14Biology-t.html?th&emc=th

On Crete, New Evidence of Very Ancient Mariners
By JOHN NOBLE WILFORD

Early humans, possibly even prehuman ancestors, appear to have been going to sea much longer than anyone had ever suspected.

That is the startling implication of discoveries made the last two summers on the Greek island of Crete. Stone tools found there, archaeologists say, are at least 130,000 years old, which is considered strong evidence for the earliest known seafaring in the Mediterranean and cause for rethinking the maritime capabilities of prehuman cultures.

Crete has been an island for more than five million years, meaning that the toolmakers must have arrived by boat. So this seems to push the history of Mediterranean voyaging back more than 100,000 years, specialists in Stone Age archaeology say. Previous artifact discoveries had shown people reaching Cyprus, a few other Greek islands and possibly Sardinia no earlier than 10,000 to 12,000 years ago.

The oldest established early marine travel anywhere was the sea-crossing migration of anatomically modern Homo sapiens to Australia, beginning about 60,000 years ago. There is also a suggestive trickle of evidence, notably the skeletons and artifacts on the Indonesian island of Flores, of more ancient hominids making their way by water to new habitats.

Even more intriguing, the archaeologists who found the tools on Crete noted that the style of the hand axes suggested that they could be up to 700,000 years old. That may be a stretch, they conceded, but the tools resemble artifacts from the stone technology known as Acheulean, which originated with prehuman populations in Africa.

More than 2,000 stone artifacts, including the hand axes, were collected on the southwestern shore of Crete, near the town of Plakias, by a team led by Thomas F. Strasser and Eleni Panagopoulou. She is with the Greek Ministry of Culture and he is an associate professor of art history at Providence College in Rhode Island. They were assisted by Greek and American geologists and archaeologists, including Curtis Runnels of Boston University.

Dr. Strasser described the discovery last month at a meeting of the Archaeological Institute of America. A formal report has been accepted for publication in Hesparia, the journal of the American School of Classical Studies in Athens, a supporter of the fieldwork.

The Plakias survey team went in looking for material remains of more recent artisans, nothing older than 11,000 years. Such artifacts would have been blades, spear points and arrowheads typical of Mesolithic and Neolithic periods.

"We found those, then we found the hand axes," Dr. Strasser said last week in an interview, and that sent the team into deeper time.

"We were flummoxed," Dr. Runnels said in an interview. "These things were just not supposed to be there."

Word of the find is circulating among the ranks of Stone Age scholars. The few who have seen the data and some pictures — most of the tools reside in Athens — said they were excited and cautiously impressed. The research, if confirmed by further study, scrambles timetables of technological development and textbook accounts of human and prehuman mobility.

Ofer Bar-Yosef, an authority on Stone Age archaeology at Harvard, said the significance of the find would depend on the dating of the site. "Once the investigators provide the dates," he said in an e-mail message, "we will have a better understanding of the importance of the discovery."

Dr. Bar-Yosef said he had seen only a few photographs of the Cretan tools. The forms can only indicate a possible age, he said, but "handling the artifacts may provide a different impression." And dating, he said, would tell the tale.

Dr. Runnels, who has 30 years' experience in Stone Age research, said that an analysis by him and three geologists "left not much doubt of the age of the site, and the tools must be even older."

The cliffs and caves above the shore, the researchers said, have been uplifted by tectonic forces where the African plate goes under and pushes up the European plate. The exposed uplifted layers represent the sequence of geologic periods that have been well studied and dated, in some cases correlated to established dates of glacial and interglacial periods of the most recent ice age. In addition, the team analyzed the layer bearing the tools and determined that the soil had been on the surface 130,000 to 190,000 years ago.

Dr. Runnels said he considered this a minimum age for the tools themselves. They include not only quartz hand axes, but also cleavers and scrapers, all of which are in the Acheulean style. The tools could have been made millenniums before they became, as it were, frozen in time in the Cretan cliffs, the archaeologists said.

Dr. Runnels suggested that the tools could be at least twice as old as the geologic layers. Dr. Strasser said they could be as much as 700,000 years old. Further explorations are planned this summer.

The 130,000-year date would put the discovery in a time when Homo sapiens had already evolved in Africa, sometime after 200,000 years ago. Their presence in Europe did not become apparent until about 50,000 years ago.

Archaeologists can only speculate about who the toolmakers were. One hundred and thirty thousand years ago, modern humans shared the world with other hominids, like Neanderthals and Homo heidelbergensis. The Acheulean culture is thought to have started with Homo erectus.

The standard hypothesis had been that Acheulean toolmakers reached Europe and Asia via the Middle East, passing mainly through what is now Turkey into the Balkans. The new finds suggest that their dispersals were not confined to land routes. They may lend credibility to proposals of migrations from Africa across the Strait of Gibraltar to Spain. Crete's southern shore where the tools were found is 200 miles from North Africa.

"We can't say the toolmakers came 200 miles from Libya," Dr. Strasser said. "If you're on a raft, that's a long voyage, but they might have come from the European mainland by way of shorter crossings through Greek islands."

But archaeologists and experts on early nautical history said the discovery appeared to show that these surprisingly ancient mariners had craft sturdier and more reliable than rafts. They also must have had the cognitive ability to conceive and carry out repeated water crossing over great distances in order to establish sustainable populations producing an abundance of stone artifacts.

http://www.nytimes.com/2010/02/16/science/16archeo.html?ref=science