Infoteca's E-Journal

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

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Bolivia's Jaguars Set a Record

During a recent camera trap survey in Bolivia, researchers from the Wildlife Conservation Society identified 19 individual jaguars, more than any previous camera trap survey in that country. (Credit: WCS Bolivia Program)

ScienceDaily (Oct. 19, 2011) — In a new camera trap survey in the world's most biologically diverse landscape, researchers for the Wildlife Conservation Society have identified more individual jaguars than ever before.

Using technology first adapted to identify tigers by stripe patterns, WCS conservationists have identified 19 individual jaguars by spot patterns in the rainforests of Bolivia, a record number for a single camera trap survey in the country. The animals were identified from a total of 975 photographs, a record number of images due to the use of digital cameras as opposed to camera traps that use film.

The images come from the Alto Madidi and Alto Heath, a region at the headwaters of the Madidi and Heath Rivers inside Bolivia's outstanding Madidi National Park. The survey also included Ixiamas Municipal Reserve, created following a previous WCS survey in 2004 along the Madidi River, which revealed a high abundance of jaguars and other species such as white-lipped peccaries, spider monkeys, and giant otters.

"We're excited about the prospect of using these images to find out more about this elusive cat and its ecological needs," said WCS Conservationist Dr. Robert Wallace. "The data gleaned from these images provide insights into the lives of individual jaguars and will help us generate a density estimate for the area."

The study is noteworthy in its use of digital camera traps replacing the traditional film units used in the past. The cameras are strategically placed along pathways in the forest and especially the beaches of rivers and streams for weeks at a time, snapping pictures of animals that cross an infrared beam. Now, researchers returning to the traps can download the images in seconds, rather than waiting days for film to develop. Before embarking on second field trip to the even more remote Heath River, Bolivian jaguar field biologist Guido Ayala noted that "series of digital images also capture more data than traditional film."

"The preliminary results of this new expedition underscore the importance of the Madidi landscape to jaguars and other charismatic rainforest species," said Dr. Julie Kunen, Director of WCS's Latin America and Caribbean Program. "Understanding the densities and ranging habits of jaguars is an important step in formulating effective management plans for what is arguably the most biodiverse landscape on the planet."

Madidi National Park is one of the top tourist attractions in Bolivia and is the centerpiece of a continuous chain of six national protected areas in northwestern Bolivia and southeastern Peru, one of the largest such complexes in the world.

Story Source:

The above story is reprinted from materials provided by **Wildlife Conservation Society**.

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http://www.sciencedaily.com/releases/2011/10/111019171128.htm

'Xplaining Generation X - An NSF-Sponsored Webcast

New study reveals surprising insights about people born between 1961 and 1981

"The Generation X Report" is scheduled for release on October 25.

October 19, 2011

Information received from this webcast is embargoed until Oct. 25, 2011 at 12:01 a.m. ET

Maybe they're the next greatest generation--Generation X. Sandwiched between the Baby Boomers and Generation Y, a new study has surprising insights about people born between 1961 and 1981. What's more, the results lead to an intriguing question: How did Gen Xers defy the prevailing wisdom to get that way?The first to grow up in the Internet Era, are Gen Xers more isolated than previous generations?

- How and in what capacity are Gen Xers spending their work lives?
- Where do church and religious organizations figure into their social fabric?
- How will Gen X office holders affect America's political and economic future?

Join University of Michigan's (U-M) Jon D. Miller for an embargoed National Science Foundation- (NSF) sponsored webcast on Friday at 1 p.m. Miller, a renowned political scientist at U-M's Institute for Social Research, is the author of "The Generation X Report," a new study scheduled for release on October 25. The report, which highlights the experiences, challenges, attitudes and behaviors of American adults now 30 to 50 years of age, is based on the NSF-funded Longitudinal Study of American Youth.

Who: Jon D. Miller, University of Michigan political scientist

What: Live embargoed teleconference and webcast for journalists.

When: Friday, Oct. 21, 2011, 1 p.m. EST.

Where: Media are invited to participate in the webcast on the phone or online via the Science360 website. (Note: the URL will only be live during the event.) Please contact webcast@nsf.gov for phone number and passcode information. Jon Miller will respond to questions from the media throughout the webcast.

Media are encouraged to direct questions before and during the webcast to webcast@nsf.gov.

-NSF-

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http://www.nsf.gov/news/news_summ.jsp?cntn_id=122044&WT.mc_id=USNSF_51&WT.mc_ev=click

Harness viruses to make dazzling colours without dye

- 15:36 20 October 2011 by **Melissae Fellet**

Tapping mandrills' colour secrets *(Image: Martin Harvey/Peter Arnold/Getty)*

Talk about a viral idea. Vibrant reds, blues, greens and yellows have been made without any dye or paint. Instead the colours arise from an intricate pattern of virus particles that reflects only certain wavelengths of light.

The patterns work in a similar way to those that produce startling colours on the faces and bills of some monkeys and birds. Now that these patterns can be made to order in the lab, they could form the basis of bleach-resistant clothing.

The blue bills of ruddy ducks (*Oxyura jamaicensis*) (pdf), the blue faces and rumps of mandrills (*Mandrillus sphinx*) (pdf) and the blue scrotum of vervet monkeys (*Chlorocebus pygerythrus*) all get their colour from the protein collagen.

Unlike pigments, whose colours arise because the molecules selectively absorb certain wavelengths of visible light, collagen has no inherent colour – it makes up the transparent lenses of human eyes, for example.

Bundles of colour

Collagen only produces colour when its fibres clump into ordered clusters, creating intricate nanostructures whose shape controls the wavelength of light that is reflected. These structures are ordered on several levels. First the protein strands twist together into bundles, then the bundles gather together.

Fascinated by this intricate, nanoscale organisation, Seung-Wuk Lee at the University of California, Berkeley, and his colleagues wondered if they could make something similar in the lab.

But instead of using collagen as their building block, the team turned to a harmless, rod-shaped virus that is naturally twisted, like collagen's protein bundles. When placed in a solution the twisted viruses have further structure, assembling themselves into clusters, sheets and helices.

Such structured fluids are known as liquid crystals. Lee's team found a simple way to "freeze" this liquid crystalline structure into a solid film: dip a glass slide into a solution of the virus and then slowly pull it out.

Wavy noodles

The pulling action brings together a collection of processes and forces at the interface between the solution, air and glass, including evaporation, surface tension and forces between the liquid and slide molecules. These conspired to produce an intricate structure that clung to the slide and solidified into stripes, "twisted ropes" or "wavy noodles" as the water evaporated.

Varying the pulling rate or the amount of virus in solution influenced how tightly the viruses stacked in the liquid crystal, allowing the researchers to tune the exact structure of the slide's solid film – and thereby its visual properties.

At low virus concentration, a transparent film emerged, similar to the collagen in our eyes, with stripes of virus standing vertically on the glass surface.

To get colours, the researchers used a larger amount of virus, which resulted in a structure where the viruses packed into strands that were assembled like stacks of long, wavy ramen noodles.

Viral clothing

Films made at high virus concentration and slow pulling speed were iridescent, meaning the colour depended on the viewing angle, while tugging at higher speeds compressed the wiggles in the noodles, creating films with uniform colour. Stripes of different colour were made on the same slide by varying the precise speed, resulting in red, blue, green and yellow stripes.

The ability to produce many different films from a single building block is a good way to make an inexpensive coating, says Amy Blum of McGill University in Montreal, Canada.

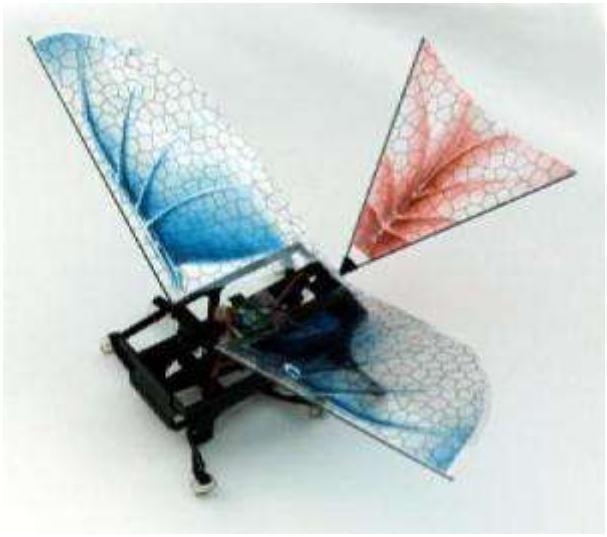
She also suggests using viruses to create bleach-resistant colour in clothing. Bleaching occurs when the chemical bonds of a pigment that absorb light of a certain frequency are modified so that they no longer do so. Since these coatings create colour in a completely different way, they may not be susceptible to bleaching.

Blum concedes, however, that it is unclear whether the virus coating would stick to cotton like it does to glass.

Journal reference: *Nature*, DOI: 10.1038/nature10513

http://www.newscientist.com/article/dn21073-harness-viruses-to-make-dazzling-colours-without-dye.html

Robotic Bug Gets Wings, Sheds Light On Evolution of Flight



Adding wings to a robotic bug improved running performance and stability. However, the boost may not have been good enough for flight. (Credit: Image by Kevin Peterson, UC Berkeley Biomimetic Millisystems Lab, All rights reserved.)

ScienceDaily (Oct. 17, 2011) — When engineers at the University of California, Berkeley, outfitted a six-legged robotic bug with wings in an effort to improve its mobility, they unexpectedly shed some light on the evolution of flight.

Even though the wings significantly improved the running performance of the 10-centimeter-long robot -- called DASH, short for Dynamic Autonomous Sprawled Hexapod -- they found that the extra boost would not have generated enough speed to launch the critter from the ground. The wing flapping also enhanced the aerial performance of the robot, consistent with the hypothesis that flight originated in gliding tree-dwellers.

The research team, led by Ron Fearing, professor of electrical engineering and head of the Biomimetic Millisystems Lab at UC Berkeley, reports its conclusions online on Oct. 18, in the peer-reviewed journal *Bioinspiration and Biomimetics*.

Using robot models could play a useful role in studying the origins of flight, particularly since fossil evidence is so limited, the researchers noted.

First unveiled by Fearing and graduate student Paul Birkmeyer in 2009, DASH is a lightweight, speedy robot made of inexpensive, off-the-shelf materials, including compliant fiber board with legs driven by a battery-powered motor. Its small size makes it a candidate for deployment in areas too cramped or dangerous for humans to enter, such as collapsed buildings.

A robot gets its wings

But compared with its biological inspiration, the cockroach, DASH had certain limitations as to where it could scamper. Remaining stable while going over obstacles is fairly tricky for small robots, so the researchers affixed DASH with lateral and tail wings borrowed from a store-bought toy to see if that would help.

"Our overall goal is to give our robots the same all-terrain capabilities that other animals have," said Fearing. "In the real world, there will be situations where flying is a better option than crawling, and other places where flying won't work, such as in confined or crowded spaces. We needed a hybrid running-and-flying robot."

The researchers ran tests on four different configurations of the robotic roach, now called DASH+Wings. The test robots included one with a tail only and another that just had the wing's frames, to determine how the wings impacted locomotion.

With its motorized flapping wings, DASH+Wings' running speed nearly doubled, going from from 0.68 meters per second with legs alone to 1.29 meters per second. The robot could also take on steeper hills, going from an incline angle of 5.6 degrees to 16.9 degrees.

"With wings, we saw improvements in performance almost immediately," said study lead author Kevin Peterson, a Ph.D. student in Fearing's lab. "Not only did the wings make the robot faster and better at steeper inclines, it could now keep itself upright when descending. The wingless version of DASH could survive falls from eight stories tall, but it would sometimes land upside down, and where it landed was partly guided by luck."

The flapping wings improved the lift-drag ratio, helping DASH+Wings land on its feet instead of just plummeting uncontrolled. Once it hit the ground, the robot was able to continue on its way. Wind tunnel experiments showed that it is aerodynamically capable of gliding at an angle up to 24.7 degrees.

Tree-dwellers vs. ground-runners

The engineering team's work caught the attention of animal flight expert Robert Dudley, a UC Berkeley professor of integrative biology, who noted that the most dominant theories on flight evolution have been primarily derived from scant fossil records and theoretical modeling.

He referenced previous computer models suggesting that ground-dwellers, given the right conditions, would need only to triple their running speed in order to build up enough thrust for takeoff. The fact that DASH+Wings could maximally muster a doubling of its running speed suggests that wings do not provide enough of a boost to launch an animal from the ground. This finding is consistent with the theory that flight arose from animals that glided downwards from some height.

"The fossil evidence we do have suggests that the precursors to early birds had long feathers on all four limbs, and a long tail similarly endowed with a lot of feathers, which would mechanically be more beneficial for tree-dwelling gliders than for runners on the ground," said Dudley.

Dudley said that the winged version of DASH is not a perfect model for proto-birds -- it has six legs instead of two, and its wings use a sheet of plastic rather than feathers -- and thus cannot provide a slam-dunk answer to the question of how flight evolved.

"What the experiments did do was to demonstrate the feasibility of using robot models to test hypotheses of flight origins," he said. "It's the proof of concept that we can actually learn something useful about biological performance through systematic testing of a physical model."

Among other robotic insects being tested in the Biomimetic Millisystems Lab is a winged, bipedal robot called BOLT (Bipedal Ornithopter for Locomotion Transitioning) that more closely resembles the size and aerodynamics of precursors to flying birds and insects.

"It's still notable that adding wings to DASH resulted in marked improvements in its ability to get around," said Fearing. "It shows that flapping wings may provide some advantages evolutionarily, even if it doesn't enable flight."

The National Science Foundation's Center of Integrated Nanomechanical Systems and the U.S. Army Research Laboratory helped support this research.

Story Source:

The above story is reprinted from materials provided by **University of California - Berkeley**.

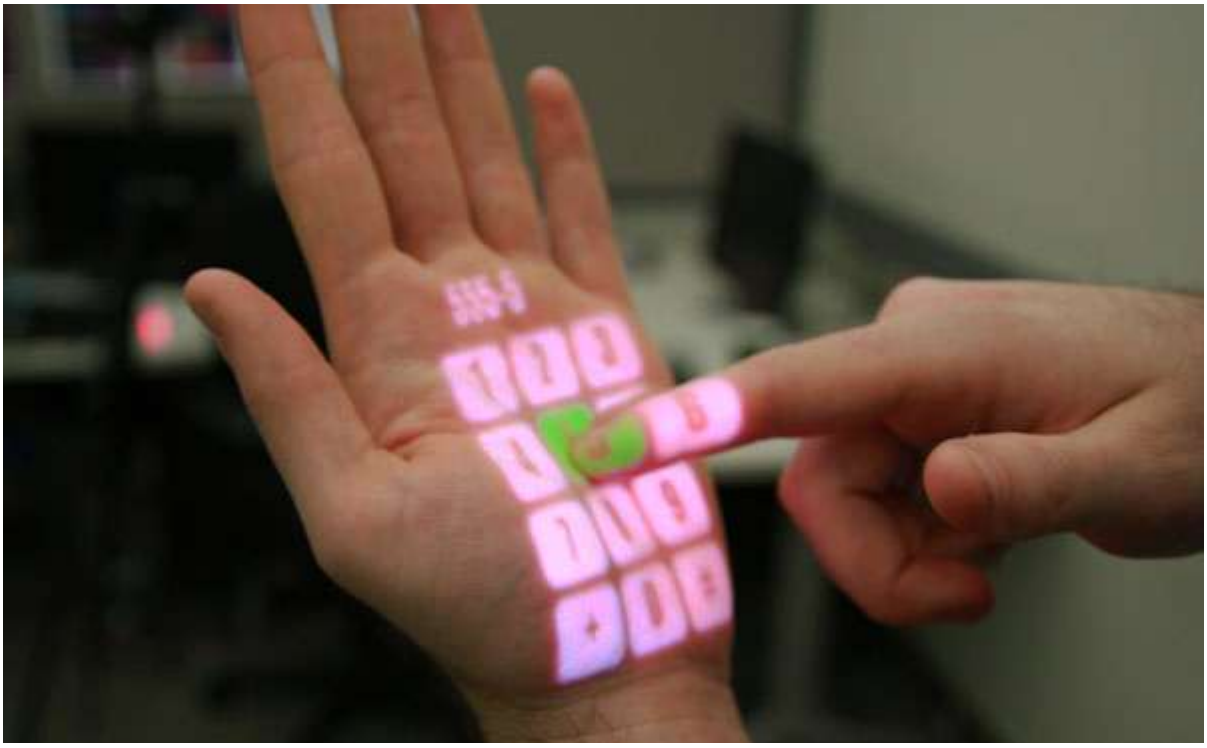
Journal Reference:

1. K Peterson, P Birkmeyer, R Dudley, R S Fearing. **A wing-assisted running robot and implications for avian flight evolution**. *Bioinspiration & Biomimetics*, 2011; 6 (4): 046008 DOI: 10.1088/1748-3182/6/4/046008

http://www.sciencedaily.com/releases/2011/10/111017214919.htm

Turn anything (even your clothes) into a touchscreen
12:31 18 October 2011

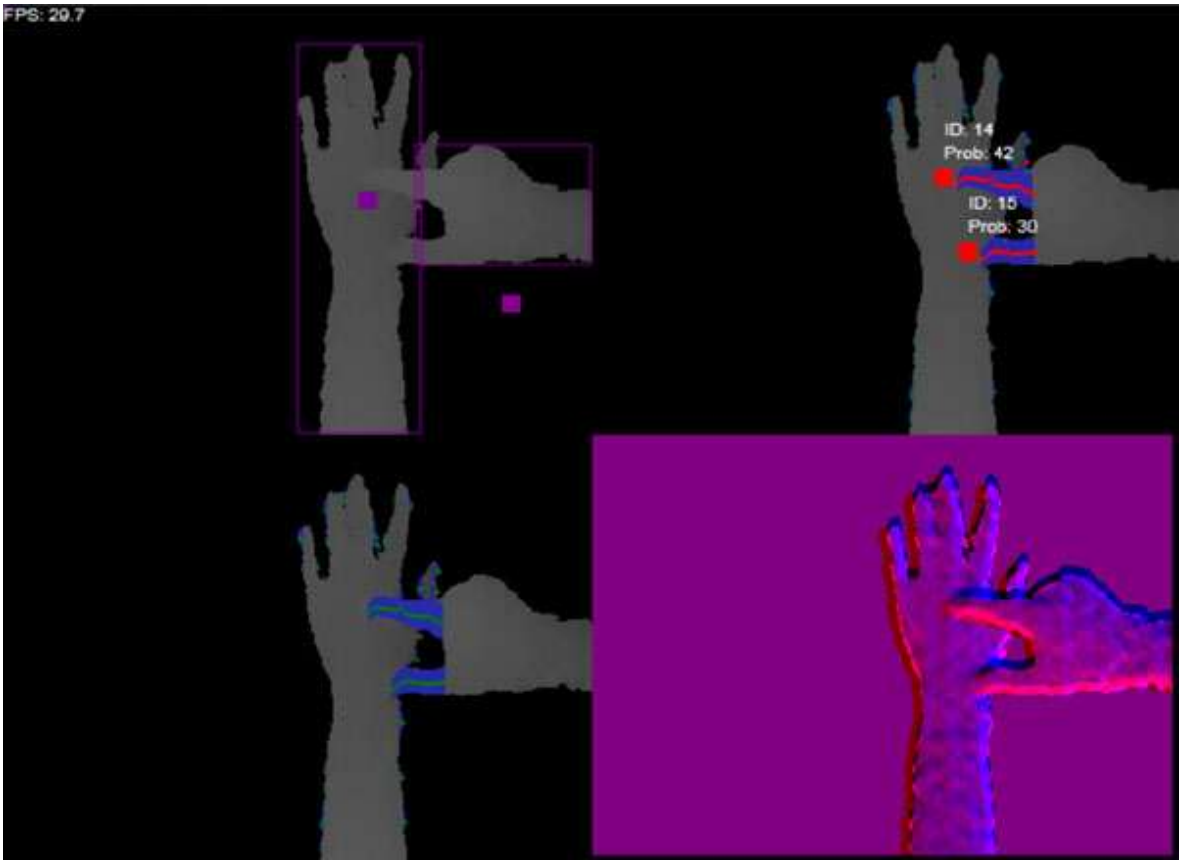
Jacob Aron, technology reporter



(Image: Chris Harrison)

Want the convenience of a touchscreen without the hassle of removing your phone from your pocket? Researchers at Microsoft have you covered, with two new touch interfaces that let you turn any surface into a touchscreen or control your phone through a trouser pocket.

OmniTouch combines a pico projector and a Kinect-like depth-sensing camera to create a shoulder-mounted device that can project a multitouch interface on to a wall, desk or even your own hand. Users can define the size and location of their own interfaces, or let the system decide the best choice of display.

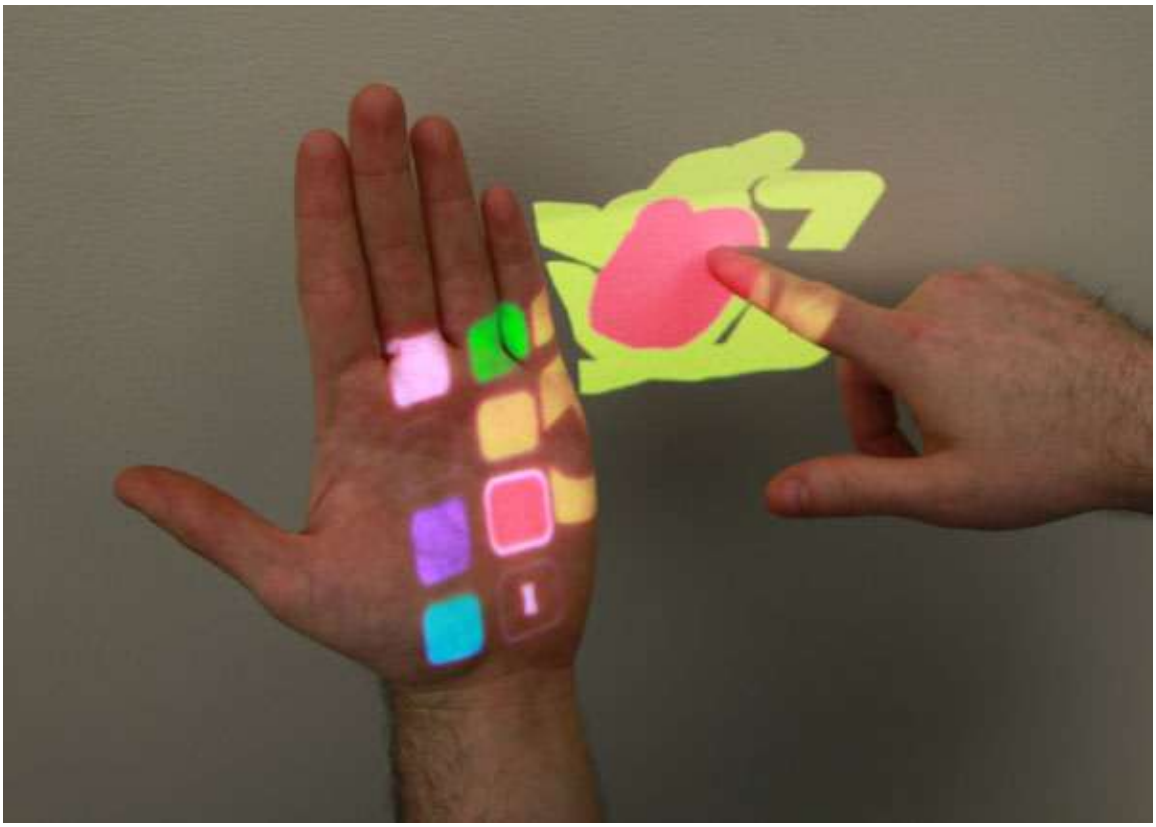


(Image: Chris Harrison)

Chris Harrison, who worked on the project, calls it a "mega Kinect hack" and an extension of his previous device which could only work on skin. While the prototype device is quite bulky, the team says it may be possible for future versions to be the size of a matchbox.

If you'd rather not project your screen for all to see, PocketTouch lets you control your phone while keeping it in your trousers. The team created a prototype device with a grid of touch sensors that can detect finger strokes through cloth and developed a specific unlock gesture that reorientates the screen each time you use it - avoiding the need to flip your phone upside down before using the interface.

They found that the screen was sensitive enough to use existing Microsoft touch recognition software, making it possible to send a text by drawing characters one by one, or control your playlist with a few strokes of your thigh. Both systems are being presented this week at the User Interface Software and Technology symposium in Santa Barbara, California.

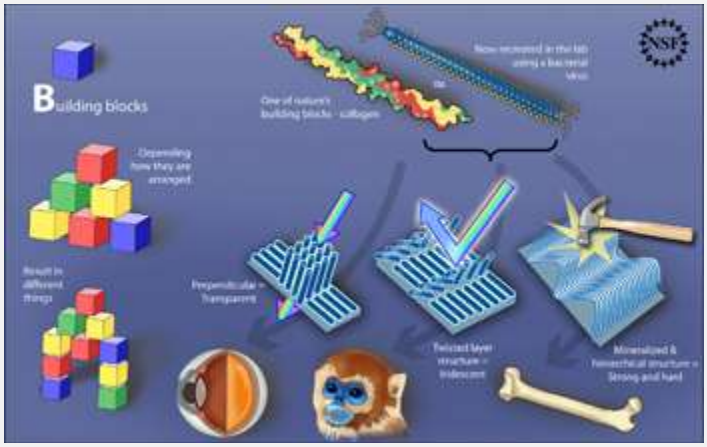


(Image: Chris Harrison)

http://www.newscientist.com/blogs/onepercent/2011/10/microsoft-demos-new-touch-inte.html

Manufacturing Goes Viral

Researchers coax viruses to assemble into synthetics with microstructures and properties akin to those of corneas, teeth and skin



This illustration reveals how the arrangement of molecular building blocks yields novel materials.
Credit and Larger Version

October 19, 2011

View a webcast with University of California at Berkeley bioengineer Seung-Wuk Lee and a YouTube video on self-templating materials assembly.

Using a simple, single-step process, engineers and scientists at the University of California at Berkeley recently developed a technique to direct benign, filamentous viruses called M13 phages to serve as structural building blocks for materials with a wide range of properties.

By controlling the physical environment alone, the researchers caused the viruses to self-assemble into hierarchically organized thin-film structures, with complexity that ranged from simple ridges, to wavy, chiral strands, to truly sophisticated patterns of overlapping strings of material--results that may also shed light on the self-assembly of biological tissues in nature.

Each film presented specific properties for bending light, and several films were capable of guiding the growth of cells into structures with precise physical orientations.

Led by University of California at Berkeley bioengineer Seung-Wuk Lee and his student and lead author Woo-Jae Chung, the researchers published their findings in the Oct. 20, 2011, issue of *Nature*.

"We are very curious how nature can create many diverse structures and functions from single structural building blocks, such as collagens for animals and celluloses for plants," says Lee. "We have thought that periodic changes in cell activity--such as from day to night, or summer to winter--cause cells to secrete different amounts of macromolecules into confined and curved micro-environments, which might play critical

roles in the formation of such sophisticated structures. We believe that biological helical nanofiber structures play a critical role in that process, yet for collagen and cellulose, it has proven quite difficult to engineer their chemical and physical properties to study their assembly process. Therefore, we have been looking for new, helical engineering materials."

The fundamental unit of the novel films is the bacteria-hunting virus, M13. In nature, the virus attacks *Escherichia coli* (*E.coli*), but in bioengineering laboratories, the virus is emerging as a nanoscale tool that can assemble in complex ways due to its long, slender shape and its chiral twist.

"Fortunately," adds Lee, "M13 also possesses an elegant helical surface that makes it a best fit for this study."

In the Berkeley laboratory, the viruses are suspended in a buffered salt solution, into which the engineers dip a thin substrate onto which the viruses can adhere.

By varying the speed at which they withdrew the substrates from the virus-rich solution, the concentration of viruses in the solution, and the ionic concentration, the researchers were able to craft three distinct categories of films.

The simplest film consisted of alternating bands of filaments, with the viral filaments in each band oriented perpendicular to the filaments in the adjacent band. Created using a relatively low concentration of viruses in the starter solution, the bands formed as the substrate rose out of the liquid with a repeated stick-slip motion.

To create films at the next hierarchical level of complexity, the researchers increased the concentration of viruses in the solution, which added more physical constraints to each filament's movement within its environment. As a result, the filaments bunched together into helical ribbons, with a handedness at a broader scale than the handedness of each individual virus.

With even higher concentrations-and in some experiments, greater substrate-pulling speed-the withdrawal yielded ever more complex, yet ordered, bundles of filaments that the researchers referred to as "ramen-noodle-like".

"Nature can dynamically change environmental variables when building new tissues to control an assembly process," adds Chung, the first author. "The beauty of our system is that we can do the same. By altering various parameters we drive assembly towards specific structures in a controlled manner. We can even make different structures on the same substrate."

By varying their techniques, the researchers altered the physical environment for the viral filaments, ultimately forcing the viruses to align into the highly specialized structural films. Each film is different, as expressed by differences in color, iridescence, polarity and other properties.

In one expression of those differences, structures built using faster-pulled substrates yielded patterns that reflected ever-shorter wavelengths of light--50 microns per minute yielded material that reflected light in the orange color range of the spectrum (600 nm), while 80 micrometers per minute yielded blue light (450 nm). The process was precise, allowing the researchers to tune the films to various wavelengths and colors, and induce polarization.

The researchers believe the hierarchical nature of the structures reflects the hierarchical growth patterns of similar biomolecules in nature, processes that result in chiral materials, like collagen, expressing themselves as the building blocks of a cornea in one level of self-assembly and the building blocks of skin tissue at a more complex level. Such self-assembly yields stunning macroscale structures--for example, skin tissue that

appears blue on birds and blue-faced monkeys is actually not expressing the light absorption from blue pigment, but the blue light scattered by complex arrays of chiral, molecular building blocks.

"We strongly believe that our novel approach to constructing biomimetic 'self-templated', supramolecular structures closely mimics natural helical fiber assembly," says Lee. "One important reason is that we not only mimicked the biological structures, but we also discovered structures that have not been seen in nature or the laboratory, like the self-assembled 'ramen-noodle structures' with six distinct order-parameters."

In addition to crafting novel biomolecular films with unique traits, the researchers also demonstrated that the films can serve as biological substrates. The team was able to grow sheets of cells that were oriented based on the texture of such substrates, with one variation incorporating calcium and phosphate to create a biomaterial similar to tooth enamel.

"This novel, self-templating, biomaterials assembly process could be used in many other organic and inorganic materials to build hierarchical structures to tune optical, mechanical and even electrical properties from nano to macro scales," adds NSF Biomaterials program director Joseph Akkara, who helped fund the project. "The reported approaches could be used to investigate mechanisms for diseases such as Alzheimer's, which is caused by amyloid aggregation in our brain tissues. More broadly, the breakthroughs could potentially yield scientific impacts in the area of tissue regeneration and repair."

The Berkeley research was conducted with support from numerous sources including the National Science Foundation.

For searchable information on NSF research conducted in California, see Research.gov.

-NSF-

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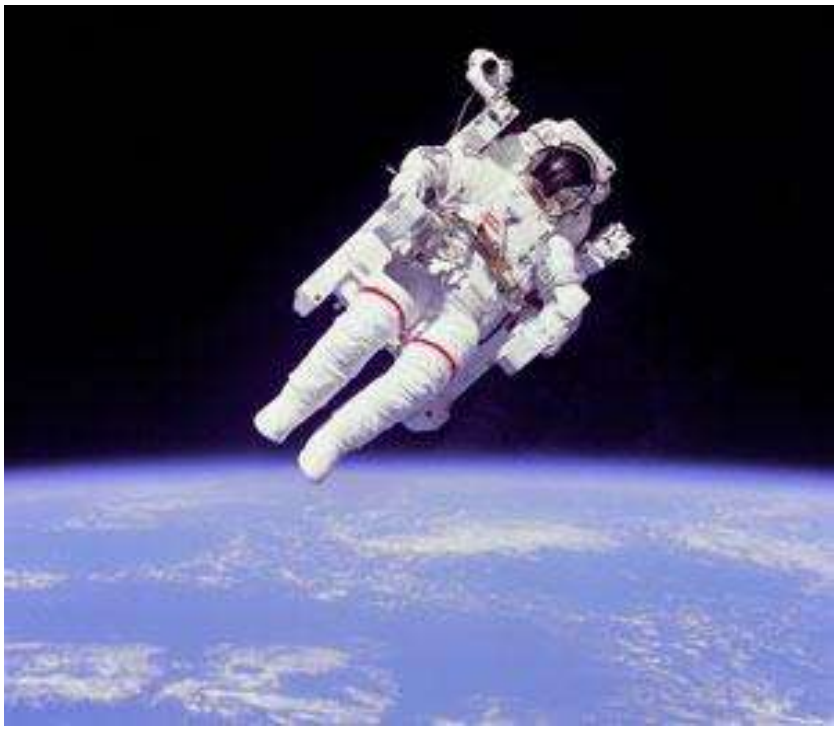
http://www.nsf.gov/news/news_summ.jsp?cntn_id=122027&WT.mc_id=USNSF_51&WT.mc_ev=click

Laser 'tractor beams' could reel in lost astronauts

- 17 October 2011 by **Paul Marks**

Magazine issue 2834.



Zap my thrusters *(Image: NASA)*

IT MUST be an astronaut's worst nightmare: floating helplessly away from your spacecraft with no hope of rescue. Such fears could be calmed by a "tractor beam" that needs no exotic physics: a laser that vaporises small thrusters on a spacesuit to push an errant spacewalker to safety.

The idea first emerged last year when John Sinko, an engineer now at Ohio State University in Newark, proposed it as a way to de-orbit space junk (*New Scientist*, 1 May 2010, p 20).

Now, working with Clifford Schlecht at the Institute for Materials, Energetics and Complexity in Greenville, South Carolina, Sinko is developing a prototype device that could save astronauts lost in space.

In Sinko's original plan, spacecraft carry thrusters with two types of propellant, each responding to a different laser wavelength. To fire a thruster, a laser beam is shone on it, vaporising propellant to create thrust and so push the spacecraft onto a new course. The propellants fire in different directions, so the spacecraft can be steered.

Sinko and Schlecht say that if those space-junk thrusters were scaled down and fitted onto a spacesuit, with tubes to vent propellant away from the astronaut, you would have a way to retrieve a spacewalker who is spinning into the void. You could even apply small thrusters to astronauts' toolboxes - one was lost during a spacewalk in 2008.

Existing rescue systems - spring-loaded or gas-driven tethers that can be fired towards an astronaut - can't reach more than 100 metres. And astronauts venturing outside the International Space Station must wear a jet pack of nitrogen thrusters. But none of these safety measures can help an astronaut who is incapacitated. The tractor beam would.

Sinko and Schlecht's calculations suggest their technique will work. By pulsing a carbon-dioxide laser on a 1-kilogram thruster for 200 seconds, they reckon they can move an astronaut back towards safety at 1 metre per second (*Journal of Propulsion and Power*, vol 27, p 1114).

But they warn that great care will have to taken to avoid accelerating the astronaut so much that they could be injured by hitting the spacecraft.

"While this looks kind of quirky and wacky, you never know - there just might be something in it," says Richard Holdaway, director of RAL Space, the space division of the Rutherford Appleton Lab near Didcot, UK.

http://www.newscientist.com/article/mg21228346.100-laser-tractor-beams-could-reel-in-lost-astronauts.html

Dark Matter Mystery Deepens

This artist's conception shows a dwarf galaxy seen from the surface of a hypothetical exoplanet. A new study finds that the dark matter in dwarf galaxies is distributed smoothly rather than being clumped at their centers. This contradicts simulations using the standard cosmological model known as lambda-CDM. (Credit: David A. Aguilar (CfA))

ScienceDaily (Oct. 17, 2011) — Like all galaxies, our Milky Way is home to a strange substance called dark matter. Dark matter is invisible, betraying its presence only through its gravitational pull. Without dark matter holding them together, our galaxy's speedy stars would fly off in all directions. The nature of dark matter is a mystery -- a mystery that a new study has only deepened.

"After completing this study, we know less about dark matter than we did before," said lead author Matt Walker, a Hubble Fellow at the Harvard-Smithsonian Center for Astrophysics.

The standard cosmological model describes a universe dominated by dark energy and dark matter. Most astronomers assume that dark matter consists of "cold" (i.e. slow-moving) exotic particles that clump together gravitationally. Over time these dark matter clumps grow and attract normal matter, forming the galaxies we see today.

Cosmologists use powerful computers to simulate this process. Their simulations show that dark matter should be densely packed in the centers of galaxies. Instead, new measurements of two dwarf galaxies show that they contain a smooth distribution of dark matter. This suggests that the standard cosmological model may be wrong.

"Our measurements contradict a basic prediction about the structure of cold dark matter in dwarf galaxies. Unless or until theorists can modify that prediction, cold dark matter is inconsistent with our observational data," Walker stated.

Dwarf galaxies are composed of up to 99 percent dark matter and only one percent normal matter like stars. This disparity makes dwarf galaxies ideal targets for astronomers seeking to understand dark matter.

Walker and his co-author Jorge Peñarrubia (University of Cambridge, UK) analyzed the dark matter distribution in two Milky Way neighbors: the Fornax and Sculptor dwarf galaxies. These galaxies hold one million to 10 million stars, compared to about 400 billion in our galaxy. The team measured the locations, speeds and basic chemical compositions of 1500 to 2500 stars.

"Stars in a dwarf galaxy swarm like bees in a beehive instead of moving in nice, circular orbits like a spiral galaxy," explained Peñarrubia. "That makes it much more challenging to determine the distribution of dark matter."

Their data showed that in both cases, the dark matter is distributed uniformly over a relatively large region, several hundred light-years across. This contradicts the prediction that the density of dark matter should increase sharply toward the centers of these galaxies.

"If a dwarf galaxy were a peach, the standard cosmological model says we should find a dark matter 'pit' at the center. Instead, the first two dwarf galaxies we studied are like pitless peaches," said Peñarrubia.

Some have suggested that interactions between normal and dark matter could spread out the dark matter, but current simulations don't indicate that this happens in dwarf galaxies. The new measurements imply that either normal matter affects dark matter more than expected, or dark matter isn't "cold." The team hopes to determine which is true by studying more dwarf galaxies, particularly galaxies with an even higher percentage of dark matter.

The paper discussing this research was accepted for publication in *The Astrophysical Journal*.

Story Source:

The above story is reprinted from materials provided by **Harvard-Smithsonian Center for Astrophysics**.

http://www.sciencedaily.com/releases/2011/10/111017124344.htm

Spaceport America conjures up spine-tingling future

- Updated 12:12 19 October 2011 by **Maggie McKee**, Truth or Consequences, New Mexico

Magazine issue 2835.

Paying passengers will board only after rocket-powered test flights *(Image: Mark Greenberg/Virgin Galactic)*

I press my face up to the window as the plane descends towards Albuquerque airport and fantasise I'm floating down from space. Future passengers landing at the nearby Spaceport America will probably be treated to a similar view: terrain gashed with canyons, mountains puckered like prunes, and white dunefields of powdered gypsum.

The spaceport is the first built for the express purpose of ferrying paying customers to the edge of space. It's a taste of the spine-tingling future envisioned by today's nascent commercial space firms. Yet one of its nearest towns, Truth or Consequences, feels like a ghost town, with many businesses shuttered. Is this really the future playground of well-heeled space tourists?

As I arrive at the spaceport, its hangar rises up from the desert dirt like a giant stingray. Right now, Spaceport America isn't quite finished. It boasts a runway and the brand new hangar, which will be used for the spaceport's first, and so far only, permanent tenant, Virgin Galactic.

But as I peek through the windows that ring its runway-facing side I see the interior is still incomplete. That makes it difficult to imagine that sometime – perhaps in the next two years – people who have paid $200,000 each will be looking out on the runway, awaiting their flight to the edge of space.

Exciting curvature

Yet that's the plan. Over 100 of those in attendance for Virgin's "dedication" of the hangar have already put deposits down to fly on Virgin's SpaceShipTwo. They watch in awe at a test flight of WhiteKnightTwo, the plane that will help the spaceship on its way. Slung between WhiteKnightTwo's two fuselages, SpaceShipTwo will be transported to 15 kilometres above Earth, before it breaks away and fires its engine to reach the edge of space. Six passengers and two pilots will then experience a few minutes of weightlessness on flights that will last a couple of hours.

"I think the first moment when I see the curvature of the Earth will be the really exciting part," says David Whitcomb, co-founder of Revolutionary Tennis Innovations, who was the 186th person to sign up for the trips. "Even if the first one crashes, I'm still going."

There are still technical hurdles to overcome before commercial trips begin. So far, Virgin Galactic has only tested SpaceShipTwo without rocket power. The rocket motor has been undergoing separate tests, and the firm hopes powered flights will begin next year.

Restricted skies

The spaceport's construction is funded by taxpayers in New Mexico. Promised that it will bring 2000 jobs to the area in the next five years, they have paid $209 million, via bonds. "We think it will help New Mexico," says Judy Wallin, a local cattle rancher. After December 2013, these bonds expire and rent from Virgin Galactic is expected to pay for operations.

Christine Anderson, executive director of the New Mexico Spaceport Authority, says New Mexico is the ideal place for a spaceport. As it is at an altitude of about 1400 metres, rockets need less fuel to take off than if they were starting out at sea level. The 330 clear days per year also help, as does the area's sparse population, which means there is less chance that a crash would endanger large numbers of people.

Perhaps best of all is its location next to the 890,000 hectare White Sands Missile Range – the site of the first space flight by a rocket launched on US soil. This means the spaceport's airspace is restricted, so no commercial aircraft fly overhead.

But White Sands' control over this airspace could be a double-edged sword. In April, Armadillo Aerospace of Texas had to leave the spaceport without flying a rocket because it could not get a suitable launch window.

Space dream

Virgin says it isn't worried. It's aiming to begin with one tourist flight per week, which shouldn't create many scheduling issues with the missile range. Eventually it wants to make two flights a day, says Brian Binnie, who piloted SpaceShipOne, an earlier version of the tourist ship, when it won the $10 million X Prize in 2004. "Twice a day, there might be some give and take with the missile range," he acknowledges. "But it'll be a nice problem to solve. I think where there's a will there's a way."

Back at the hangar, Richard Branson, Virgin's founder, accepts a placard announcing the spaceport's address – 1 Half Moon Street – from Apollo 11 moonwalker Buzz Aldrin. Acrobats – including Branson – dangle from the spaceport wall to perform a gravity-defying routine and I spot Kate Winslet mingling through the crowd.

I know it's just PR, but I am dazzled. I hope that the spaceport pans out so that more than just loan companies can flourish in Truth or Consequences. Congressman Steve Pearce echoes my thoughts. "People are desperate and hungry to believe that there is still a sense of a dream, a sense of adventure – a sense that we're going to be OK."

http://www.newscientist.com/article/dn21060-spaceport-america-conjures-up-spinetingling-future.html

What's the Greenest Building? The Problem With Ranking Systems

By Auden Schendler & Mike Toffel
Oct 19 2011, 12:02 PM ET

The huge role of policy in solving the world's environmental problems suggests that corporate activism should be considered in all best-of lists

What if there was a building that was so "green" that it was awarded the well-regarded Silver LEED rating? And what if that building housed a company that, among other things, was spreading disinformation about climate science that was undermining public support for climate-change regulations and the U.S. EPA? A fairly basic question would come to mind: is that building really green?

Actually, such a building exists. It's the New York City headquarters of News Corp, where Rupert Murdoch runs an empire that is "set up to deny, deny, deny" the most pressing environmental issue of our time -- climate change -- according to *Rolling Stone*. The magazine reported last winter that News Corp's "*Wall Street Journal* routinely dismisses climate change as 'an apocalyptic scare,' and Fox News helped gin up a fake controversy by relentlessly hyping the 'climategate' scandal'" -- even though multiple independent investigations showed that nothing in the scientists' emails undermined their conclusions about global warming.

Including advocacy in criteria will make rankings more accurate, but will also steer consumers and investors in a positive direction.

Rolling Stone named Murdoch #1 in its list of Politicians and Execs Blocking Progress on Global Warming, noting "no one does more to spread dangerous disinformation about global warming than Murdoch."

Ouch.

Despite all this, the question of whether News Corp's building deserves its prominent green rating could be easily dismissed. LEED rates buildings, not the advocacy of its occupants.

Well, fair enough. But following that line of thinking, neither is it the job of corporate ranking systems (like the one released in *Newsweek* this week) to measure anything but operational greenness -- how a corporation deals with solid waste, maximizes energy efficiency, and avoids smokestack pollution on their sites, and in some cases in their supply chains. So, for example, News Corp. came in at number 234 this year among the 500 U.S. companies *Newsweek* ranked. Its ranking hardly suggests that this business carries more responsibility than almost any other in preventing policy solutions to the climate crisis. And earlier this year, News Corp.'s climate change performance was given a AAA rating, the highest possible score provided by MSCI ESG Research's Global Socrates, another major rating scheme.

The world is facing huge environmental problems, and climate change is the marquee. The Intergovernmental Panel on Climate Change calls for CO2 reductions of 80-95 percent below 1990 levels by 2050. That aggressive target offers just a 50/50 chance of preventing a global average temperature rise of 2 degrees C, beyond which millions are put at risk of drought, hunger, and flooding. What's necessary to fix climate change is a radical recreation of society as we know it, from how we use and generate energy to how we tax pollution and encourage efficiency. The problem is so big, and so inclusive, that it can't be solved by ad hoc voluntary actions. Even if every corporation or individual so inclined undertook the full menu of climate fixes, we'd still fail to solve the problem by many orders of magnitude because business-as-usual would remain the norm on a global level. Only large-scale policy change can fix that. Therefore, an exclusive focus on voluntary operational greening -- by businesses or by rating agencies -- risks distracting from the far greater need for the big fix.

Compared to companies' efforts to green their own operations, political actions -- like campaign funding, or lobbying Congress or the court of public opinion -- can have a vastly greater influence on environmental protection, and arguably represent the biggest impact a company can have on the environment. In fact, the very existence of a debate on climate science in the United States, and consequent lack of policy action, has been attributed to massive corporate support for the "denial industry," as detailed in Naomi Oreskes and Erik Conway's book *Merchants of Doubt*. The U.S. Chamber of Commerce, for example, spent $132 million on lobbying in 2010, more than any other entity, and opposed all climate legislation. Corporate influence on government policy will only increase after last year's *Citizens United* Supreme Court case, which allows corporations to spend unlimited amounts on elections.

The primacy of policy in solving the world's environmental problems suggests that corporate activism should be considered in all corporate environmental rankings. Ignoring advocacy is like rating colleges based on their buildings and infrastructure while ignoring the quality of educational content.

It's certainly feasible: some metrics already exist. For example, ratings could reward companies that take leadership positions, such as when Pacific Gas & Electric (PG&E) quit the U.S. Chamber of Commerce, citing its "extreme position on climate change." Corporate Responsibility's 100 Best Corporate Citizens already credits companies that are members of the U.S. Climate Action Partnership, a group calling for the U.S. government "to quickly enact strong national legislation to require significant reductions of greenhouse gas emissions," though this is just one of the 324 factors considered. Ratings could also penalize companies for belonging to organizations that undermine climate change regulation. Would IBM still be *Newsweek*'s #1 ranked U.S. company if the rankings weighed the fact that IBM is not only a member, but a board member, of the U.S. Chamber of Commerce? Rankings could also account for corporate campaign contributions to politicians who deny that climate change is a problem, as the Climate Action Network Europe did last year based on data publicly available from the Center for Responsive Politics. In the end, any sort of environmental ranking -- from LEED to ISO 14001, the world's most respected certification of environmental management -- should include corporate activism and influence in its assessment.

Including advocacy in their criteria will not only make rankings more accurate, but will also be good for the planet by steering consumers and investors in a positive direction -- along with rated companies themselves. Businesses respond to negative ratings.

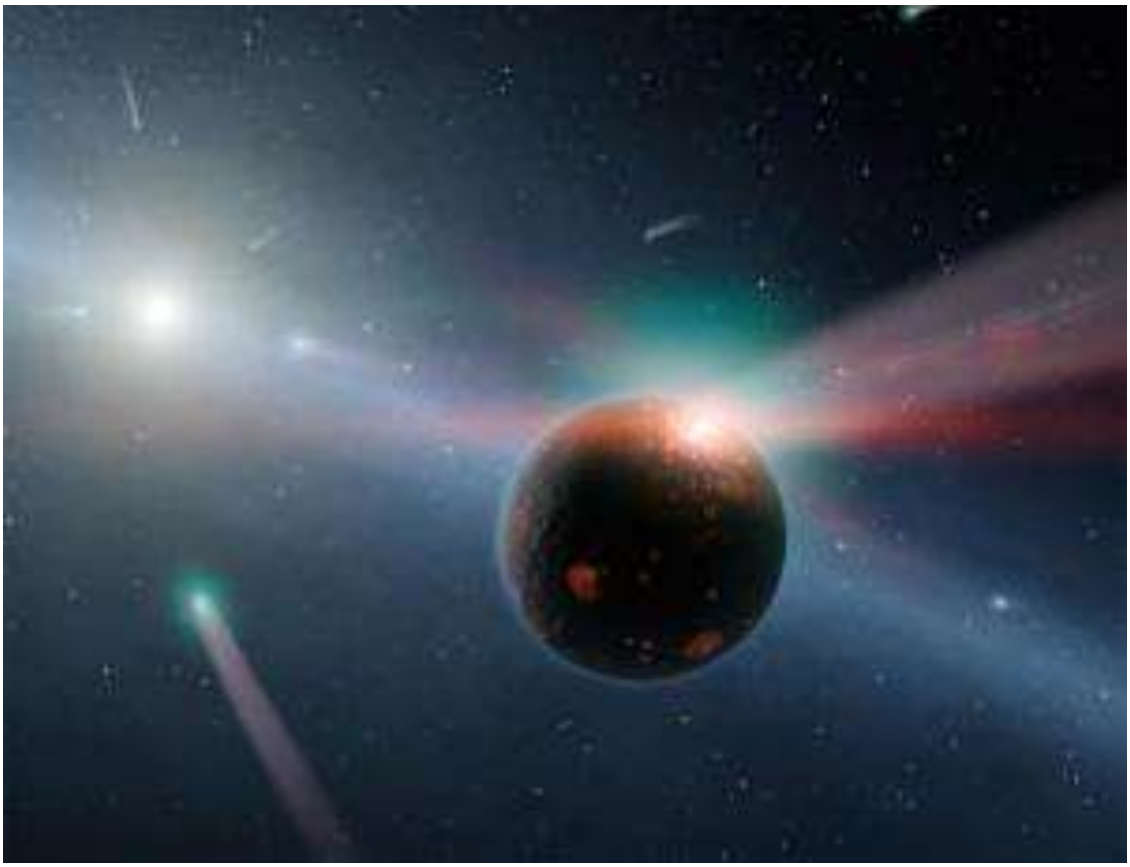
Just one last question comes to mind: Suppose the corporation in the green building is ranked highly not only on its operational efficiency but also on its advocacy, as it should be. And what if that company's business is mining coal?

Image: Wikimedia Commons.

http://www.theatlantic.com/life/archive/2011/10/whats-the-greenest-building-the-problem-with-ranking-systems/246965/

Comets may be creating oceans on alien planet

- 23:30 19 October 2011 by **Lisa Grossman**



Cosmic snowball fight (Image: NASA/JPL-Caltech)

Comets have been caught battering an exoplanet for the first time, new observations suggest. If the existence of the planet is confirmed, the finding means that the impacts are bringing water and organic material – the essential ingredients for life – to a world that lies in the habitable zone around its star.

The cometary shower is taking place around a bright star about 60 light years away called Eta Corvi, which is visible to the naked eye in the northern sky.

The Spitzer Space Telescope spotted the infrared glow of a band of dust three times as far from Eta Corvi as Earth is from the sun. Carey Lisse of the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, and his colleagues analysed the spectrum of light from this glow and found that it contains water, organics and rock.

The composition and amounts seen suggest that several small comets, or a single large one, crashed into a rocky world weighing up to a few times the mass of the Earth, creating a trail of debris behind the planet. For example, the dust seems to contain nanodiamonds, which form when organic materials smack into each other at ludicrous speeds, and bits of silica – essentially glass, which forms when rock melts and then quickly re-freezes.

Astronomers already knew that Eta Corvi had a stockpile of comets: a bright ring of cold dust is seen about 150 times as far from the star as Earth is from the sun. Our solar system has an equivalent band called the Kuiper belt, an icy reservoir of leftover planet pieces where comets are born.

Barrage of impacts

The Spitzer observations suggest the planet, whose existence has not been confirmed by other methods, is suffering its own version of the solar system's "late heavy bombardment", in which a barrage of comets scarred the inner planets around 4 billion years ago. It was triggered when Jupiter and Saturn shifted positions, flinging icy bodies from the solar system's frozen fringe inwards. Eta Corvi, a relatively young star, might have a distant Neptune-like planet doing the same.

"What we've done is looked at a nearby star that's about the same age as our sun was when this happened, and we can actually see it going on, see the process of this happening," Lisse said in a press teleconference on Wednesday.

Some astrobiologists believe that comets carried water and organics – the building blocks of life – to Earth. Life on Earth emerged suggestively soon after the late heavy bombardment ended around 3.8 billion years ago, Lisse noted, and it wouldn't have taken much water to make the dry planet habitable.

Conveniently, the comet collision appears to be right at the distance from the star where liquid water can exist on a planet's surface. "We're showing the mechanism for [water] delivery is possible, at least in one star system," Lisse said. "The delivery of water and organics is to a place where you could actually grow life, as we know it."

Common process?

The researchers also found that the cloud around Eta Corvi also matches the composition of the Almahata Sitta meteorite, which astronomers tracked as it fell to Earth in 2008. The similarity suggests that the meteorite had its origins in the Kuiper belt.

"This could be a direct example of bringing water, organics and things that help life grow to the Earth," Lisse said.

Although they now have two examples of comet showers raining down on infant rocky worlds, Lisse and colleagues aren't sure it's a common occurrence in nascent solar systems. "It's not clear to me whether this is a typical system," he said. If late heavy bombardment-type events are very rare, it could explain why life appears to be rare as well. It is possible that "you don't form life unless they happen", he said.

Lisse presented the results on Wednesday at the Signposts of Planets meeting at NASA's Goddard Spaceflight Centre in Greenbelt, Maryland. They will also appear in the *Astrophysical Journal*.

http://www.newscientist.com/article/dn21066-comets-may-be-creating-oceans-on-alien-planet.html

Future Forests May Soak Up More Carbon Dioxide Than Previously Believed

An aerial view of the 38-acre experimental forest in Wisconsin where U-M researchers and their colleagues continuously exposed birch, aspen and maple trees to elevated levels of carbon dioxide and ozone gas from 1997 through 2008. (Credit: David Karnosky, Michigan Technological University)

ScienceDaily (Oct. 13, 2011) — North American forests appear to have a greater capacity to soak up heat-trapping carbon dioxide gas than researchers had previously anticipated.

As a result, they could help slow the pace of human-caused climate warming more than most scientists had thought, a U-M ecologist and his colleagues have concluded.

The results of a 12-year study at an experimental forest in northeastern Wisconsin challenge several long-held assumptions about how future forests will respond to the rising levels of atmospheric carbon dioxide blamed for human-caused climate change, said University of Michigan microbial ecologist Donald Zak, lead author of a paper published online this week in *Ecology Letters.*

"Some of the initial assumptions about ecosystem response are not correct and will have to be revised," said Zak, a professor at the U-M School of Natural Resources and Environment and the Department of Ecology and Evolutionary Biology in the College of Literature, Science, and the Arts.

To simulate atmospheric conditions expected in the latter half of this century, Zak and his colleagues continuously pumped extra carbon dioxide into the canopies of trembling aspen, paper birch and sugar maple trees at a 38-acre experimental forest in Rhinelander, Wis., from 1997 to 2008.

Some of the trees were also bathed in elevated levels of ground-level ozone, the primary constituent in smog, to simulate the increasingly polluted air of the future. Both parts of the federally funded experiment -- the carbon dioxide and the ozone treatments -- produced unexpected results.

In addition to trapping heat, carbon dioxide is known to have a fertilizing effect on trees and other plants, making them grow faster than they normally would. Climate researchers and ecosystem modelers assume that in coming decades, carbon dioxide's fertilizing effect will temporarily boost the growth rate of northern temperate forests.

Previous studies have concluded that this growth spurt would be short-lived, grinding to a halt when the trees can no longer extract the essential nutrient nitrogen from the soil.

But in the Rhinelander study, the trees bathed in elevated carbon dioxide continued to grow at an accelerated rate throughout the 12-year experiment. In the final three years of the study, the CO_2-soaked trees grew 26 percent more than those exposed to normal levels of carbon dioxide.

It appears that the extra carbon dioxide allowed trees to grow more small roots and "forage" more successfully for nitrogen in the soil, Zak said. At the same time, the rate at which microorganisms released nitrogen back to the soil, as fallen leaves and branches decayed, increased.

"The greater growth has been sustained by an acceleration, rather than a slowing down, of soil nitrogen cycling," Zak said. "Under elevated carbon dioxide, the trees did a better job of getting nitrogen out of the soil, and there was more of it for plants to use."

Zak stressed that growth-enhancing effects of CO_2 in forests will eventually "hit the wall" and come to a halt. The trees' roots will eventually "fully exploit" the soil's nitrogen resources. No one knows how long it will take to reach that limit, he said.

The ozone portion of the 12-year experiment also held surprises.

Ground-level ozone is known to damage plant tissues and interfere with photosynthesis. Conventional wisdom has held that in the future, increasing levels of ozone would constrain the degree to which rising levels of carbon dioxide would promote tree growth, canceling out some of a forest's ability to buffer projected climate warming.

In the first few years of the Rhinelander experiment, that's exactly what was observed. Trees exposed to elevated levels of ozone did not grow as fast as other trees. But by the end of study, ozone had no effect at all on forest productivity.

"What happened is that ozone-tolerant species and genotypes in our experiment more or less took up the slack left behind by those who were negatively affected, and that's called compensatory growth," Zak said. The same thing happened with growth under elevated carbon dioxide, under which some genotypes and species fared better than others.

"The interesting take home point with this is that aspects of biological diversity -- like genetic diversity and plant species compositions -- are important components of an ecosystem's response to climate change," he said. "Biodiversity matters, in this regard."

Co-authors of the Ecology Letters paper were Kurt Pregitzer of the University of Idaho, Mark Kubiske of the U.S. Forest Service and Andrew Burton of Michigan Technological University. The work was funded by grants from the U.S. Department of Energy and the U.S. Forest Service.

Story Source:

The above story is reprinted from materials provided by **University of Michigan**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Donald R. Zak, Kurt S. Pregitzer, Mark E. Kubiske, Andrew J. Burton. **Forest productivity under elevated CO_2 and O_3: positive feedbacks to soil N cycling sustain decade-long net primary productivity enhancement by CO_2.** *Ecology Letters*, 2011; DOI: 10.1111/j.1461-0248.2011.01692.x

http://www.sciencedaily.com/releases/2011/10/111013153955.htm

Chile's high oasis of huge telescopes

- 17 October 2011 by **Valerie Jamieson**, Atacama desert, Chile

Magazine issue 2834.

Galaxies dance across the Chilean sky under the VLT's watchful eye *(Image: Gianluca Lombardo/ESO)*

AS THE sun sets on the 2600-metre Cerro Paranal mountain in Chile, the nightly choreography at the European Southern Observatory begins. The domes housing each of the four 8-metre mirrors that make up the Very Large Telescope spin around almost silently, and mighty doors slide open to give the telescopes their first glimpse of the emerging stars.

I watch in awe and blink furiously as my contact lenses dry out. Staff astronomer Jonathan Smoker had warned me earlier about the effects of working in the Atacama desert, the most parched place on the planet. "If you stay here for long your skin dries out," he said. "Sometimes it's so bad that my hands bleed."

Water vapour in the atmosphere blocks certain wavelengths of light. So the extreme dryness is one reason why Chile is a magnet for astronomers (see "Giants on Chile's mountains"). Ambitious new observatories are in the works. Cerro Paranal's altitude above sea level is another - the VLT's optical and infrared view of the sky is uninterrupted by clouds and the atmosphere is so thin there is not even enough turbulence to make the stars twinkle, pretty for you and me but an annoying source of error for astronomers. The "seeing", in other words, is just about perfect, and has enabled the observatory to find the oldest star in the universe and to image worlds beyond our solar system. "The VLT produces one peer-reviewed paper per day," says astronomer Valentin Ivanov.

I don't even have to look up to appreciate this for myself. The stars stretch across the sky from one horizon to the next, and I finally fulfil my ambition to see the Milky Way in all its glory. Smudges that look like clouds are our neighbouring dwarf galaxies, the Small and Large Magellanic Clouds, visible only from the southern hemisphere.

Even Cerro Paranal is not high or dry enough to get a good look at the sky at millimetre wavelengths. So an international coalition is building the Atacama Large Millimeter/submillimeter Array (ALMA) at an altitude about twice as high on Chile's Chajnantor plateau, home to the highest observatories on Earth.

Getting there is no mean feat. From Paranal, it is a 6-hour drive east through mining towns and bleak desert landscapes, where the only sign of colour comes from shrines honouring people killed on the roads.

We get there and stop for a safety briefing on altitude sickness at 2900 metres - the "low site" - before moving on to see ALMA's current complement of 20 radio dishes at 5000 metres. There the air is so thin my head starts to pound and I cannot think clearly. No one goes there unless they have to - ALMA's dishes are controlled from the low site. We do not stay long.

ALMA just snapped its first image, showing cold gas in the Antennae galaxies, a pair of colliding spiral galaxies 70 million light years away. Another 46 dishes are being assembled at the low site, and when they are all in place, they should reveal other hidden regions of cold gas and dust where stars and planets form - as well as untold surprises. "It's all the things we don't know out there that are going to be interesting," says ESO astronomer Diego Garcia-Appadoo.

Giants on Chile's mountains

Chile could one day be home to yet another giant telescope. An hour's bone-shaking drive away from Cerro Paranal, across a boulder-strewn landscape that looks like the surface of Mars, is Cerro Armazones.

The 3000-metre-high mountain could be home to a behemoth called the European Extremely Large Telescope, measuring 39.3 metres across. Capable of collecting nine times as much light as any other optical telescope, it could discover Earth-like planets in the habitable zones around other stars and search for changes over time in the fundamental physical constants.

If the European Southern Observatory's 15 member states agree to the project, work will begin next year to blow the top off the mountain so that the 5000-tonne telescope's foundations can be laid. Stargazing could begin in a decade.

http://www.newscientist.com/article/mg21228344.900-chiles-high-oasis-of-huge-telescopes.html

Paris Syndrome: A First-Class Problem for a First-Class Vacation

By Chelsea Fagan
Oct 18 2011, 9:01 AM ET 3

At least 20 people this summer -- most of them Japanese -- have suffered from the disorder after realizing Paris isn't what they expected

As tourist season here in Paris winds to a close and the air once again becomes crisp, fresh, and new, we must unfortunately acknowledge that it does not end without a few casualties. Yes, this summer, like the ones that have come before it, has claimed at least 20 victims of a very particular affliction: Paris Syndrome. And though it may sound like a disease unique to freshman girls with Le Chat Noir posters everywhere, it is a serious disorder that causes tourists, especially Japanese tourists, many problems on their trip through the City of Light. And what is Paris Syndrome, exactly? Simply put, it's a collection of physical and psychological symptoms experienced by first-time visitors realizing that Paris isn't, in fact, what they thought it would be.

It is no secret that the representation of Paris in entertainment is a limited one. If the subject matter even makes it past the World War II era, one is still usually going to get a fairly idealized picture. Watching movies set in Paris leaves one with an image of the city that is quaint, friendly, affluent, and likely still in black-and-white. When we use Paris in advertisements, it is invariably some non-threateningly attractive young woman riding a bike around the side streets or skipping down the Champs-Elysées, daintily nibbling a macaroon. We imagine the whole city just smells like Chanel No. 5 and has a government-mandated mime on every corner. And nowhere is this narrow view of Paris more prevalent than in Japan, where the media portrays the city as one filled with thin, gorgeous, unbelievably rich citizens. The three stops of a Parisian's day, according to the Japanese media, are a cafe, the Eiffel Tower, and Louis Vuitton.

This illness seems to have taken its place as the 21st century gout -- just slightly too privileged a problem to sympathize with.

Yet, despite our international desire to imagine that this is a city where pigeons stay in the parks and the waiters occasionally burst into song, Paris can be a harsh place. It has its share of social problems: crime, filth, inequality, and -- our special treat for the visitors -- not-so-friendly locals. Parisians are constantly

breaking new scientific ground when it comes to being unaccommodating and even disdainful towards foreigners. If you do not speak French, you can look forward to stumbling through many uncomfortable, labored conversations with people who resent your very existence. The service industry, too, is notorious for treating tourists like something they recently scraped from the bottom of their shoes. Even the public transportation, instead of being the jolly metro cars in antique underground stations we see in films, are hot, overcrowded carriages filled with groping couples, screaming children, and unimaginably loud accordion music.

And while this does not stop Paris from being a wonderful, beautiful city -- every city has its pros and cons -- the fact that its downsides are wiped so institutionally clean from the media isn't doing it any favors. Unlike New York, which embraces its gritty underbelly in its public image -- "Hey, you might get shot walking to the post office, but that's what makes it fun!" -- the world seems determined to represent Paris as perpetually spinning inside a little girl's music box. This disparity between what we see and what we get hits tourists, and it hits some of them very hard.

Paris Syndrome manifests itself differently in different people, but amongst the most common symptoms are acute delusions, hallucinations, dizziness, sweating, and feelings of persecution. The shock of coming to grips with a city that is indifferent to their presence and looks nothing like their imagination launches tourists into a psychological tailspin which, in at least six cases this year, necessitated the patient being flown back to his or her country under medical supervision. Usually, though, bed rest and hydration seem to take care of the problem within a few days. The Japanese Embassy, though, has had no shortage of people who, in the throes of the Syndrome, call or visit to be reassured that the city is not going to collapse in upon them.

This illness seems to have taken its place as the 21st century gout -- just slightly too privileged a problem to sympathize with. One imagines women with large, ornate folding fans fainting on street corners and mustachioed men's monocles dropping, with a little tinkle, into champagne glasses. Yet, for those who succumb to it, Paris Syndrome and its after-effects are very, very real. Sufferers have reported being traumatized by the experience, of fearing ever traveling again.

But what is the city to do about it? Should they accept that there is an actual medical condition associated with how much of a disappointment Paris can be? Should they embrace the risk? Even if they went that route, what PR firm would be capable of turning "some people are hospitalized from how scary and mean our city turns out to be" into "Paris: Only the strong survive"? No, it is in Paris' best interest to continue feeding into the rose-colored glasses the world seems so ready to see it through. Paris tourism only climbs with every *Amélie*, or Dior perfume commercial directed by Sofia Coppola. Last summer, the image all over Paris' tourism brochures was a gorgeous model with a small Eiffel Tower strapped to her forehead with red, white, and blue ribbon. She was, literally, a Gallic unicorn. That is how far their delightful, twee little presentation has been taken.

So how can tourists prepare themselves for the City of Light, and avoid being rushed home with a doctor on an emergency flight back to their homeland? If repeated viewings of *La Haine* and *Taken* are not appealing, and extensive reading on the 2005 suburb riots would require too much time on Wikipedia, they could always just remind themselves of the realities of the city they're so excited to visit. They could remember that obesity is a growing problem in France, that McDonald's, KFC, and Subway are popping up like acne all over the city, and that pickpocketing and mugging are some of the most common crimes in the area. They can remember that, despite how beautiful the sun is setting behind the Eiffel Tower, at the base of the structure, there are sure to be hundreds of pushy men screaming at you to buy their 1-Euro trinkets. They can remember that it is not a tipping culture here, servers are getting paid the same amount either way, so their attitude towards you will depend solely on how nice you are willing to be to them. The customer is not always right -- he simply exists. That is as far as the Parisian waiter is willing to take it.

With these things in mind to balance out a shoebox full of Doisneau's most charming photos, one can expect a Paris that meets the reasonable portrait in one's imagination. The city will be dirty, crowded, loud, and indifferent -- but it will be beautiful and breathtaking. And as long as one does not expect the furniture to spring to life and help you get ready for your dance with the Beast, a trip to this city will be fulfilling, exciting, and, most importantly, free of debilitating hallucinations.

Image: Moyan Brenn/Flickr.

http://www.theatlantic.com/life/archive/2011/10/paris-syndrome-a-first-class-problem-for-a-first-class-vacation/246743/

Original spin: Was the universe born whirling?

- 17 October 2011 by **Anil Ananthaswamy**
- Magazine issue 2834.

Was the universe born whirling? *(Image: Scame/Shutterstock)*

A big bang that was also a big spin could explain a surprising alignment of galaxies – not to mention the origin of matter itself

ALBERT EINSTEIN was right about many things. The universe was not one of them. To him, as to many before him, the cosmos was a static, unchanging entity. In 1915, on deriving his equations of general relativity and discovering that the universe they described did not work like this, he added in an extra term to make sure that it did.

Whoops. A decade later, observations of nearby galaxies revealed that the universe is far from static, but has expanded furiously since its birth in an infinitely hot, dense fireball billions of years ago: the big bang.

That's not all. In the 1990s, light from distant supernovae convinced us that the universe's expansion is accelerating. That was posthumous luck for Einstein: the fudged term in his equations was revived to describe a "dark energy" fuelling that acceleration.

So the universe is both expanding and accelerating. Fine. Now, though, hold on to your hats - it might be spinning, too.

That is what physicist Michael Longo at the University of Michigan in Ann Arbor thinks he has found. If so, a wholesale review of our assumptions about the cosmos would be on the cards - and perhaps a solution to one of its biggest mysteries, the puzzling fact of matter's existence. As an anonymous peer-reviewer of Longo's most recent paper wrote: "Such [a] claim, if proven true, would have a profound impact on cosmology and would very likely result in a Nobel prize." What gives?

At the heart of the story is a basic rule called the law of conservation of parity. Nature, it says, does not discriminate between physical processes and objects and their mirror images. Take a spinning top: it does not spin clockwise and anticlockwise in any fundamentally different way. In mathematical shorthand, we say a quantity called parity remains the same whenever you flip a spatial coordinate and make things point or move in the opposite direction.

Heretical question

Except, of course, when it doesn't. For a start, biology thumbs its nose at parity. Chiral molecules come in distinct right and left-handed forms that react in different ways. Amino acids, the building blocks of proteins, favour left-handedness over right. Why this might be is a mystery.

Then there are particles. Between Christmas Day and New Year's Eve 1956, when most people around them were enjoying a well-earned break, a group of physicists led by Chien-Shiung Wu was studying the radioactive beta decay of spinning cobalt-60 nuclei at the National Bureau of Standards in Washington DC. Assuming parity conservation, the nuclei should have emitted a beta particle, or electron, just as often along the direction of their spin as in the opposite direction.

But they didn't. About 70 per cent more electrons were emitted against the nuclear spin. The weak nuclear force, which governs beta decay, favours objects and processes that move in certain directions. That insight was crucial in later establishing the standard model of particle physics, and the two theorists who had proposed the effect, Tsung-Dao Lee and Chen Ning Yang, were awarded a Nobel prize in short order the following year.

So if it happens on small scales, might parity conservation also be disregarded on large scales, perhaps on the very largest? That's the question Longo began pondering a few years ago. "The fact that the universe might violate parity was pretty fascinating," he says.

Fascinating - and heretical. The assumption of cosmic parity conservation is tied up with what is known as the cosmological principle: that wherever you are in the universe, and in whatever direction you look, things on average look the same. The universe does not tell left from right; in fact, it knows no special places or directions at all. As far as the philosophical bases of modern cosmology go, things don't come more fundamental than that.

That makes Longo's findings all the odder. In 2007, he was mining the databases of the Sloan Digital Sky Survey (SDSS), a project that since 2000 has been using a 2.5-metre telescope at Apache Point Observatory in Sunspot, New Mexico, to collect images of about a million galaxies across the northern sky. He was looking for spiral galaxies whose swirling arms were clearly visible, showing what direction the galaxies are spinning in.

That was not easy. Many spirals face us at the wrong angle for their arms to be clear, while bursts of star formation in others suggest recent collisions and mergers that might have disrupted their original spin. Longo soon whittled an initial 40,000 galaxies located within 540 million light years down to just 2817 clear examples.

Synchronised spinning

All other things being equal, you would have expected these galaxies generally to be spinning in random directions, according to local conditions when they formed. And that indeed was the case. In most sectors of the northern sky, equal numbers of galaxies were rotating to the right, or clockwise, and to the left, anticlockwise. But along one direction, at about 10 degrees to our own galaxy's spin axis, there were more

left-handed spirals than right-handed ones. That was intriguing, but nothing more. "It gave a positive result, but with that number of galaxies the statistical significance was marginal," says Longo.

By 2010, there were some 230,000 suitable galaxies in the SDSS database, and Longo decided to take another look. This time, he needed a team of graduate students to repeat his analysis. They ended up with a sample of 15,158 clearly rotating spiral galaxies, the farthest 1.2 billion light years away.

The effect was not just still there, it was stronger. This time, there was just a 0.006 per cent chance of it being a statistical fluke (*Physics Letters B*, vol 699, p 224).

That's when Longo looked at the southern sky, which is not covered by the SDSS. Back in 1991, astronomers Hajime Sugai of the University of Tokyo and Masanori Iye of the National Astronomical Observatory of Japan had compiled a catalogue of the spin direction of about 8000 southern galaxies using data from the European Southern Observatory's telescope in La Silla, Chile. They had been looking for a similar "dipole" effect of more galaxies spinning one way than the other, but had given up the chase. "We did see some evidence for the presence of a dipole," says Masanori. "But it was not very significant."

Longo saw something they hadn't. Stretching off as far as the telescope could see, along the same axis in the southern sky, there was a clear excess this time of right-handed spirals. It was the same effect, only in reverse.

For Longo, that pointed to a mind-boggling conclusion. "If this asymmetry is real, it means the universe has a net angular momentum," he says. Angular momentum, like energy, cannot be created or destroyed, so that means it must also have been born in a spin. Only that would explain why galaxies along one line, the universe's own original spin axis, received an extra kick to make most of them rotate in the same direction.

And the universe might well be spinning still. Not that we would notice. "We can't see the spinning, because we are inside, and we can't see outside, so we can't directly show it's spinning," says Longo. Nevertheless, if the idea stands up, it is a bombshell. The universe is not the same wherever you look; it has special directions in which certain things occur and others do not. Parity is violated; the cosmological principle seems weakened.

Let's start with what that does not mean: Earth is not in a special place. Although it might look as if we are ideally positioned to look along the universe's unique spin axis, all of space expanded from just one infinitesimally small point at the big bang. The original spin axis has expanded with it, so wherever you are in the cosmos, it will be there too, pointing in the same direction (see diagram).

As to what might have set the universe spinning, or what the observations might say about the possibility of other universes beyond, Longo would rather not speculate. As far as the interior workings of our cosmos are concerned, though, his findings have set at least one cosmologist in a spin. "I was blown away," says theorist Stephon Alexander of Haverford College in Pennsylvania. It sits well with an idea he has been pushing for the best part of a decade - one that he thinks could also explain another asymmetry: why matter dominates antimatter in our cosmos.

This is one of the thorniest problems in physics. The standard model says that there is absolute symmetry between matter and antimatter; both should have been created in equal amounts after the big bang, and would have annihilated each other completely within a fraction of a second. The existence of galaxies, stars, planets, dust and life made of matter is, to put it mildly, an embarrassment to this otherwise wildly successful theory.

There is a way nature could have engineered matter's dominance: through a phenomenon known as CP violation. This idea emerged from asking whether, if the weak nuclear force does not respect parity (P) alone, there are symmetries it does respect. One answer was that it might respect parity and charge (C) conservation

together. In effect, this means if you take a process such as a particle reaction, flip in it a mirror and simultaneously swap all the particles for identical particles of the opposite charge - their antiparticles - the reaction should proceed as before.

That is not the case. Experiments from the 1960s onwards revealed that CP symmetry is also broken by the weak force; a reaction and its mirror-inverted, charge-reversed equivalent proceed at slightly different rates. The Soviet physicist Andrei Sakharov showed in 1967 that a hugely CP-violating process at work in the early universe, when matter and antimatter were being produced, could explain why the one won out over the other.

But what process? In 2004, Alexander, then at the Stanford Linear Accelerator Center in Menlo Park, California, and colleagues identified a possible culprit: gravity, the only one of the four fundamental forces of nature not covered by the standard model.

They showed that a two-step process might pull off the desired trick. If gravity violated the law of parity conservation in the first instants after the big bang, that would have produced ripples in space-time, gravitational waves, asymmetrically. This was a time when the universe entered a period known as inflation, during which it expanded colossally and both matter and antimatter particles were produced. The asymmetric gravitational waves would have interfered with the field causing inflation, biasing the production of matter over antimatter (*Physical Review Letters*, vol 96, p 081301).

"That work had a beauty in that it related the amplitude of gravitational waves with the matter-antimatter asymmetry," says theoretical physicist Robert Brandenberger of McGill University in Montreal, Canada. "If a new mechanism relates two, in principle, very different observational quantities, that makes it a very interesting theoretical model." Interesting, yes - but true?

Leaving aside the huge question of what might make gravity violate parity in the first place, Alexander found at least some succour for his model in the cosmic microwave background. This afterglow of the big bang has been propagating towards us from all sides ever since the universe expanded and cooled enough to let photons through, some 370,000 years into its existence. The radiation has a uniform temperature of some 2.725 kelvin, but look closely and you see warmer and colder spots. This dappling is even across the sky, except when you look on the very largest scales. Then some of the spots seem to start lining up, all pointing in pretty much the same direction. In 2005, Kate Land and Joao Magueijo of Imperial College London dubbed this alignment the "axis of evil".

NASA's WMAP team, which has created stunningly detailed maps of the cosmic background radiation, says that while "the fact of the alignment is not in doubt", it is best explained as a statistical fluke (arxiv.org/abs/1001.4758). Others are less sure, and the issue of strange patterns in the background radiation will not go away. And as far as Alexander is concerned, it is just the kind of effect his asymmetric gravitational waves would produce.

Now along comes Longo. Intriguingly, the axis along which galaxies seem to be rotating with the same handedness is in roughly the same direction as the axis of evil. "It suggests they are related," he says. Alexander thinks he knows how.

It is too early for him to have incorporated the details of the galaxy asymmetry into his work explicitly, but he sees a suggestive thread: an initially spinning universe brought on a parity-violating asymmetry in gravity that allowed matter to triumph over its antimatter rival. And that process left two marks behind: the axis of evil in the cosmic background radiation, and the inconspicuous alignment of galaxies that Longo has spotted.

That's certainly a well-spun yarn. Luckily, we should soon have the data to decide whether it is fiction or reality. The European Space Agency's Planck satellite is set to provide the most detailed map of the cosmic

background radiation ever made. If Planck, like WMAP, finds an axis of evil, it would be the best sign yet that the effect is genuine.

Masanori's team also plans to use the National Astronomical Observatory of Japan's 8.2-metre Subaru Telescope on Mauna Kea, Hawaii, to study northern galaxies in greater detail. "We will be able to [see] a huge number of galaxies with much finer resolution to judge the spin orientation more easily," he says. The Large Synoptic Survey Telescope, with an 8.4-metre mirror and 3200-megapixel camera, will study the southern skies from Cerro Panchón in Chile from 2020.

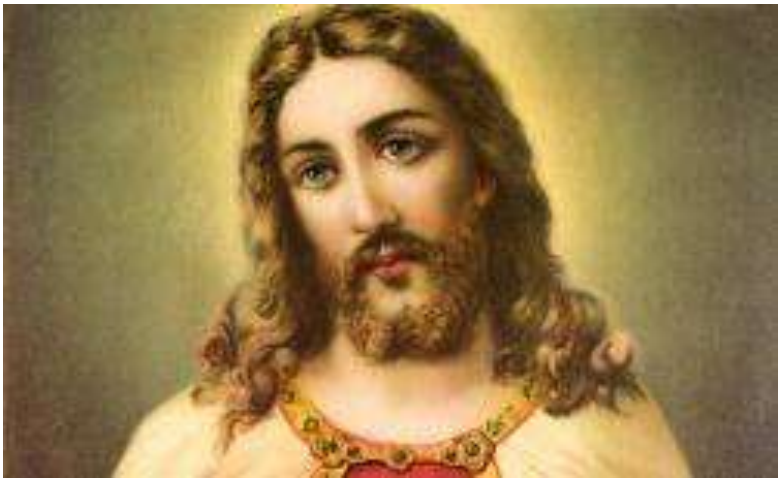
That should settle the question of the spinning universe one way or the other. Will we have been wrong yet again about how the universe works? If so, the door really would be open for that Nobel prize.

Anil Ananthaswamy *is a consultant for New Scientist*

http://www.newscientist.com/article/mg21228342.300-original-spin-was-the-universe-born-whirling.html?full=true&print=true

Why Does God Love Beards?
A discussion of facial hair in world religions.

By Brian Palmer|Posted Tuesday, Oct. 18, 2011, at 5:35 PM ET



Jesus Christ

Photograph by Jozef Sedmak/Hemera/Thinkstock.

An Amish splinter group has gone on a crime spree, forcibly cutting the beards off of their rivals. Many religions, including Sikhism, Islam, and sects of Judaism, encourage or require their men to keep beards. Jesus Christ is often depicted with a beard. Why does God like facial hair so much?

Because it's manly. Although beards appear repeatedly in religious texts, God never explicitly tells us why they're so holy. In the absence of any divine exposition, many theologians have posited that a hairy face is a symbol of masculinity bestowed upon men by God. St. Clement of Alexandria, who was among the most emphatic proponents of this view, argued: "But for one who is a man to comb himself and shave himself with a razor, for the sake of fine effect, to arrange his hair at the looking-glass, to shave his cheeks, pluck hairs out of them, and smooth them, how womanly! And, in truth, unless you saw them naked, you would suppose them to be women." St. Augustine seconded Clement's characterization, noting, "The beard signifies the courageous; the beard distinguishes the grown men, the earnest, the active, the vigorous. So that when we describe such, we say, he is a bearded man." The beard soon fell out of favor among clerics, though, and Christian holy men were forbidden to sport facial hair for several centuries before the ban was relaxed during the Renaissance. In today's world, Protestants and Catholics are more likely to follow prevailing facial hair fashions, while Orthodox Christians tend to stick to the biblical, pro-beard view.

Muslim scholars have long argued over the importance of beards. Some view shaving as haram, or forbidden, because the prophet and his immediate followers wore beards. Others argue that shaving is merely makruh, or undesirable, because there isn't a specific Quranic prohibition on it. As in Christianity, a number of theologians believe that the beard is holy because it is part of God's distinction between man and woman. One Pakistani scholar noted: "The Prophets of Allah kept beards and expressed their liking for it since this is from among the norms of human nature. It is an expression of manliness and as such a sign, which distinguishes men from women."

Keeping a long beard is one of the main tenets of Sikhism, and again there are indications that the commandment relates to masculinity. Sant Jarnail Singh Bhindranwale, a controversial Indian militant Sikh, argued, "If you do not want beards then you should urge the women to become men and you should become women."

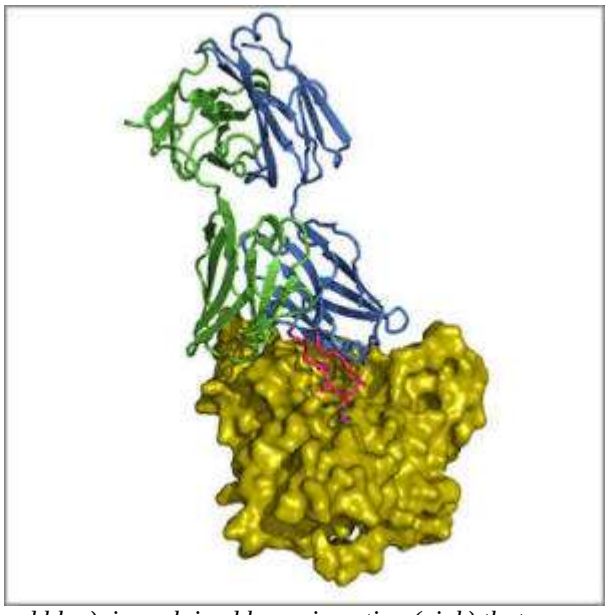
Several Hindu communities shave their men as part of religious rites, and scholars interpret the act as returning the participant to an infantile condition, without hair or gender. The freshly shorn subject is forbidden to have sex for a prescribed period. (These groups do not shave men as part of the rite of marriage.) Ascetics who keep themselves permanently hairless give up sex entirely.

As with other bearded religions, the Amish appear to wear their beards as a sign of manhood, and the recent attacks are consistent with the ancient Judeo-Christian tradition of forcibly shaving an enemy to emasculate him. The Ammonites humiliated the emissaries of King David by shaving their beards. In the Book of Judges, Samson loses his strength when his hair is cut. (Samson lost all of his head hair, not just his beard.)

Masculinity isn't the only proposed explanation for why religious groups have favored them. Some communities kept beards to distinguish themselves from their nonbelieving neighbors. Ancient Near Eastern art portrayed Israelites as bearded, while the hated Philistines were clean-shaven. There are Muslim scholars who think the prophet wore a beard to distinguish his followers from Christians.

http://www.slate.com/articles/news_and_politics/explainer/2011/10/many_religions_require_their_men_to_grow_beards_why_does_god_lik.html

Building Better HIV Antibodies: Biologists Create Neutralizing Antibody That Shows Increased Potency



The increased potency of a new HIV antibody (green and blue), is explained by an insertion (pink) that contacts the inner domain of the HIV gp120 spike protein (yellow). (Credit: Ron Diskin/Caltech)

ScienceDaily (Oct. 27, 2011) — Using highly potent antibodies isolated from HIV-positive people, researchers have recently begun to identify ways to broadly neutralize the many possible subtypes of HIV. Now, a team led by biologists at the California Institute of Technology (Caltech) has built upon one of these naturally occurring antibodies to create a stronger version they believe is a better candidate for clinical applications.

Current advances in isolating antibodies from HIV-infected individuals have allowed for the discovery of a large number of new, broadly neutralizing anti-HIV antibodies directed against the host receptor (CD4) binding site -- a functional site on the surface of the virus that allows for cell entry and infection. Using a technique known as structure-based rational design, the team modified one already-known and particularly potent antibody -- NIH45-46 -- so that it can target the binding site in a different and more powerful way. A study outlining their process was published in the Oct. 27 issue of *Science Express*.

"NIH45-46 was already one of the most broad and potent of the known anti-HIV antibodies," says Pamela Bjorkman, Max Delbrück Professor of Biology at Caltech and senior author on the study. "Our new antibody is now arguably the best of the currently available, broadly neutralizing anti-HIV antibodies."

By conducting structural studies, the researchers were able to identify how NIH45-46 interacted with gp120 -- a protein on the surface of the virus that's required for the successful entry of HIV into cells -- to neutralize the virus. Using this information, they were able to create a new antibody (dubbed NIH45-46^{G54W}) that is better able to grab onto and interfere with gp120. This improves the antibody's breadth -- or extent to which it effectively targets many subtypes of HIV -- and potency by an order of magnitude, according to Ron Diskin, a postdoctoral scholar in Bjorkman's lab at Caltech and the paper's lead author.

"Not only did we design an improved version of NIH45-46, our structural data are calling into question previous assumptions about how to make a vaccine in order to elicit such antibodies," says Diskin. "We hope that these observations will help to guide and improve future immunogen design."

By improving the efficacy of antibodies that can neutralize HIV, the researchers point to the possibility of clinical testing for NIH45-46^{G54W} and other antibodies as therapeutic agents. It's also plausible that understanding effective neutralization by powerful antibodies may be useful in vaccine development.

"The results uncover the structural underpinnings of anti-HIV antibody breadth and potency, offer a new view of neutralization by CD4-binding site anti-HIV antibodies, and establish principles that may enable the creation of a new group of HIV therapeutics," says Bjorkman, who is also a Howard Hughes Medical Institute investigator.

Other Caltech authors on the study, "Increasing the Potency and Breadth of an HIV Antibody by Using Structure-Based Rational Design," include Paola M. Marcovecchio, Anthony P. West, Jr., Han Gao, and Priyanthi N.P. Gnanapragasm. Johannes Scheid, Florian Klein, Alexander Abadir, and Michel Nussenweig from Rockefeller University, and Michael Seaman from Beth Israel Deaconess Medical Center in Boston also contributed to the paper. The research was funded by the Bill & Melinda Gates Foundation, the National Institutes of Health, the Gordon and Betty Moore Foundation, and the German Research Foundation.

Story Source:

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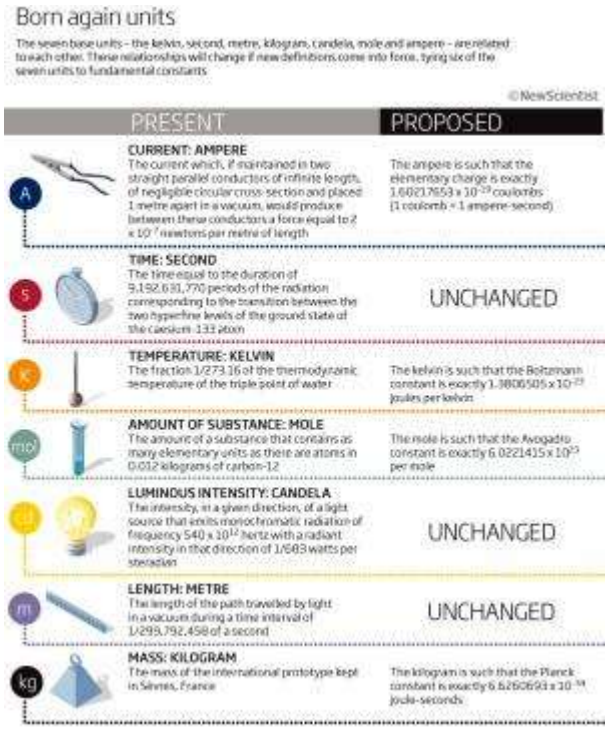
http://www.sciencedaily.com/releases/2011/10/111027145855.htm

Agreement to tie kilogram and friends to fundamentals

- 17:22 25 October 2011 by **Richard Fisher**



Born-again units

After decades of worry, toil and argument, metrologists have officially begun the process of tying the definitions of four basic units to nature's fundamental constants.

The General Conference on Weights and Measures (CGPM) in Paris, France, has unanimously agreed on a proposal that would lead to reform of the mole, kilogram, kelvin and ampere, according to the international system of units (SI).

That puts us on the cusp of a historic change in the way science sizes up the world. If the next CGPM, in four years' time, confirms the plan, it will amount to the biggest change to the SI units for a century.

Proponents of the switch are thrilled. "Not a single vote against! It was unbelievable," says Ian Mills of the University of Reading, UK.

Metal shock

Nearly all measurements we make are ultimately based on the SI, with a chain of laws and rules leading back to just seven base units. The way that these units are defined doesn't matter so much for weighing vegetables, say, but many scientific experiments require precise measurement, especially in areas like fundamental physics.

The first sign that the SI was flawed was noticed in 1949 in a check on a lump of metal kept inside a vault at the International Bureau of Weights and Measures (BIPM) in Paris. By definition, it is the only object in existence with a mass of exactly 1 kilogram – one of the seven SI base units – so metrologists were unsettled to discover that this mass had changed.

Not liking to rush into anything, however, no one checked the standard kilogram again until 1989. The problem had not gone away.

The metre and the second are two base units that don't have anything like this to worry about. They are defined with reference to the speed of light – a link to a fundamental constant that makes them robust. Much of the rest of the SI, however, isn't in great shape.

Planck and Avogadro

A drifting kilogram means that the mole, the unit that chemists use for measuring the amount of a substance, is in trouble too. The kelvin is currently defined according to the property of water in a certain state – a fact that makes precise measurements at very high or low temperatures impossible. Meanwhile, the ampere's definition is so impractical that electrical researchers have had to turn to a definition outside the SI system based on quantum processes instead.

See more: Click here to see the present and proposed SI unit definitions

In 2006, after decades of little action, Mills and fellow metrologists Terry Quinn, Peter Mohr, Edwin Williams and Barry Taylor argued in the journal *Metrologia* that the four problematic units should be tied to fundamental constants of the universe instead. The seventh, the candela, could wait.

For the kilogram, they suggested using the Planck constant, which relates the energy of electromagnetic radiation to its frequency. The Planck constant can also be used to define the Avogadro constant, the number of atoms in 12 grams of carbon-12, which in turn can be used to obtain the mole.

A fixed value is also possible for another constant, the elementary charge carried by one proton or electron, which can be used to define the ampere. For the kelvin, you can use the Boltzmann constant, which relates thermal and mechanical energy.

Persuasive power

Mills and colleagues had their work cut out to actually make this happen, though. The process of changing the SI units requires a vote by representatives of the member states of the CGPM, which meets only once every four years and is notoriously slow and bureaucratic.

What's more, the reformers had to persuade conservative elements within the CGPM of the necessity of the changes. The conservatives resisted such a switch, claiming that the extra precision was unnecessary and that there was a risk the changes could be wrong.

Mills and colleagues, however, believe that metrology should always be one step ahead: ever-increasing precision is what the field is all about. "We're impeding progress if we refuse," says Mills.

The metre used to be defined by a scratch on a metal bar and the second was linked to the rotation of the Earth, he points out. At the time people were happy enough, but without exquisite accuracy in measuring time and distance, for example, we couldn't use satellites for GPS.

Tense lobbying

On 17 October, Mills stood up in front of the CGPM audience to make the case. It was only a 10-minute presentation, but among the most important of his career. He and colleagues had drafted a proposal that would set the body on a path to change the SI.

Five tense days of behind-the-scenes discussions and lobbying later, Mills and his colleagues learned that the CGPM had unanimously backed the proposal.

Although the decision will not be binding without another vote in four years' time, this approval makes the switch much more likely. "This is a unanimous public statement," says Mills.

At his age, Mills accepts that he himself may not get to see the new system put in place. "It'll happen," he told *New Scientist* earlier this month. "It may be after I'm gone. I'm 81 years old. But it'll happen."

http://www.newscientist.com/article/dn21091-agreement-to-tie-kilogram-and-friends-to-fundamentals.html?full=true&print=true

Growing Girl

Edith Scovell; introduced by Andrew McCulloch

Published: 4 October 2011

I n his obituary of Edith Joy Scovell (1907–99) the poet John Mole spoke movingly of the "sense of quiet astonishment" at the heart of her work, a description that would seem to apply as much to her career as it does to her poetry. Mole says he knew nothing about her until he read her poem "The Evening Garden" in the Listener in 1980 and cut it out to keep – later discovering that Vita Sackville-West had done the same thing: "it was in Life and Letters", Sackville-West wrote on the dust jacket of her copy of Scovell's second collection, The Midsummer Meadow, "that I first came across some verses by E. J. Scovell and was so much struck by them that I cut them out to stick in a private anthology". It is this appeal of her poetry to private and intimate concerns rather than public and political ones that perhaps accounts for the fact that, although she was at Oxford with W. H. Auden and Louis MacNeice, she did not publish her first collection until 1944 when, as she said, "the war created a need, or a liking for poetry of all kinds".

This is not to suggest that her choices of familiar, often domestic themes limit her work: "Growing Girl" seems, in some ways, to anticipate the Philip Larkin of High Windows (1974); only that, to quote Mole again, "such quiet undercurrents of continuity beneath the flood of reputation are surely essential to the survival of true poetry". The watery metaphor is appropriate here. The to and fro of the children's tennis ball becomes, by association with "the coasts" of the watching woman's face, the ebb and flow of the sea, soothing and restless, lapping her "undiscovered", "untilled" slopes at the same time as leaving crueller marks on "cheek and temple". While the half-rhymes of the sestet's first three lines suggest a dreamy suspension of time, the last three full rhymes insist on its inexorable forward march.

Growing Girl

Watching from the high brick wall
The younger children's tennis in the lane
Her eyes run thoughtless with the ball,
And the coasts of her face rise clear and plain.

Undiscovered or forsaken wholly
Against the sky those slopes and dunes lie now,
Moulded in natural melancholy
Of untilled country, chin and cheek and brow.

The hour absorbs the players and the girl
Dreaming above the clematis. The ball
Coming and going weaves its spell,

And her eyes with the ball run to and fro.
Only the tracks of cheek and temple know
She has a long journey to go.

E. J. SCOVELL (1951)

http://www.the-tls.co.uk/tls/public/article790443.ece

Quantum hackers: Cracking the uncrackable code

- 25 October 2011 by **Helen Knight**

Magazine issue 2835.

Quantum cryptography is under attack from cunning eavesdroppers who have worked out how to fool the system (*Image: Paul Taylor/Stone +/Getty*)

It promised the ultimate in security, but quantum cryptography is under attack – from cunning eavesdroppers who have worked out how to fool the system

WHEN Vadim Makarov boards an aircraft, he carries with him a bright yellow suitcase. Inside is a jumble of wires and connections, and a large black-and-white symbol that looks unnervingly like a skull and crossbones.

But while the contents of his suitcase might give airport security staff cause for concern as it passes through their X-ray machines, it poses no threat. Instead, Makarov uses it to eavesdrop on quantum cryptography systems, which transmit top-secret information in networks across the world. Fortunately, his mission is benign. Makarov, a researcher at the Norwegian University of Science and Technology in Trondheim, hopes to detect loopholes in these quantum networks before they are spotted by hackers.

Some may regard his job as unnecessary. Quantum cryptography is meant to harness the laws of quantum mechanics to catch eavesdroppers before they can do damage. For this reason, it has often been hailed as "uncrackable" encryption. "There's been the impression that since it is based on the laws of physics, its security is guaranteed," says Makarov.

Once you put the technique into practice, however, it's another matter. Makarov's group and others have already found some weak spots in quantum cryptography, and there are potentially many more.

Any weaknesses will be a cause for concern for the many operations that already use this form of encryption to transmit secure messages. Since 2007, quantum key distribution (QKD) has been used to send the results of Swiss elections securely from local centres to the State of Geneva's central data repository. It is also being used 24 hours a day by banks, multinational companies and some hospitals to transmit confidential information to remote backup centres.

For such commercial clients, QKD promises security that seems future-proof. A typical technique of conventional cryptography is to encode messages using encryption keys made from the product of two large prime numbers. In order to read these messages, a hacker would need to retrieve the original primes, a factorisation process that takes an unfeasibly long time, even for the most powerful computers. "But there is no evidence that it's impossible, it is just that the best algorithm has not yet been found," says Nicolas Gisin, an expert in quantum cryptography at the University of Geneva in Switzerland.

Should a technological development come along that made it possible to crack these prime numbers quickly, all electronic financial transactions would collapse in an instant, he says. "It would be an enormous crisis that would make the credit crunch look like a joke."

QKD, on the other hand, should unveil any eavesdroppers before they tap into the important data. To understand how this works, you need to meet Alice and Bob - two imaginary figures who want to send a secret key. In the most widespread implementation of QKD, Alice, the sender, creates the key by encoding a string of 0s and 1s in the polarisation of individual photons. She has two systems for doing this - using either vertical or horizontal polarisation, or "diagonal" polarisations of plus or minus 45 degrees. When sending the digits to Bob, Alice randomly alternates between these systems.

What makes QKD supposedly so secure is that, until it is measured, a quantum object such as a polarised photon can exist in a "superposition" of all its possible polarisation states. At Bob's end, this stream of quantum bits hits a beam splitter that randomly diverts each photon to one of two sets of receivers, each equipped to deal with one of the two polarisation systems. If the set matches the system used to encode the photon, Bob will measure a definitive state, the one encoded by Alice, and the correct result. If, however, the photon hits the other set, the detector will measure a superposition state and get a random result - half of the time it will be correct, and half of the time wrong.

That second outcome would not present a problem because after the message has been transmitted, Alice and Bob can compare which systems they used to send and receive each photon to work out which recordings to eliminate. This leaves them with a string of digits - the key - which Bob can then use to decode a scrambled message sent via a conventional communications link.

But suppose then that an eavesdropper, Eve, attempts to intercept the data and then resend the signal. Like Bob, she would also record the wrong data when she chose the wrong type of receiver to decode the photons. In doing so, however, she would collapse the superposition and polarise the photon into whatever state she measured it in, passing this state rather than Alice's original on to Bob. The result would be that when Bob and Alice compared notes to decide on the final key, they would see unexpected errors in the transmission, alerting them to Eve's presence.

This, in theory, should make QKD systems impenetrable. But in 2008, Makarov and his team of quantum hackers decided to challenge the idea. "We had an inkling that once you started to scrutinise the devices used to implement the system, loopholes might emerge that could be exploited with today's technology," he says.

To search for these weaknesses, Makarov's team began to investigate the detectors that would be used by Bob to read Alice's messages. Most systems use a type of detector called an avalanche photodiode, which generates an electrical pulse when it receives a single photon. When the team played with this setup, they

found that they could "blind" the detectors with a short pulse of bright light, raising the detectors' threshold so that they no longer responded to single photons.

However, if a second, stronger pulse was sent, the detectors would respond. Thanks to the way the beam is divided among the different receivers, Eve could engineer this pulse so that it would fall under the threshold of three of the detectors, but above the threshold of the remaining detector, to register whatever digit she wanted (see diagram). In this way, she could read Alice's message, and resend the correct sequence to Bob, without creating an increase in the error rate (arxiv.org/abs/0809.3408).

Once the quantum hacking team had demonstrated that this attack was possible in the lab, they borrowed two commercial QKD systems, one developed by ID Quantique, based in Geneva in Switzerland, the other by Magiq Technologies in Boston, Massachusetts. Working with colleagues at the Max Planck Institute for the Science of Light in Erlangen, Germany, they demonstrated that both commercial systems were vulnerable to attack. They published their results in a paper in *Nature Photonics* in 2010 (vol 4, p 686). "This seems to be a common feature of all detectors used in QKD," says Makarov. "We have tested seven different detector models, and they could all be blinded and controlled."

Having undermined the security of quantum systems, the next step was to attempt to eavesdrop on an entire message sent between Alice and Bob. In June, Makarov's crew took their yellow suitcase containing their Eve apparatus to the Centre for Quantum Technologies at the National University of Singapore. There, they joined forces with a team led by Christian Kurtsiefer to hack a working QKD system. Tapping into the middle of a 290-metre fibre-optic cable linking Alice and Bob, they managed to eavesdrop on an entire 300,000 digit key within minutes (*Nature Communications*, DOI: 10.1038/ncomms1348). "The QKD system generated the key at the same rate and with the same parameters as before Eve was placed on the line," says Makarov. "The eavesdropper went completely unnoticed."

What's more, attack by blinding is not the only option available to potential Eves. Since Makarov first announced his hacking plan, some other ingenious lines of attack have been discovered. For instance, Harald Weinfurter and colleagues at the Ludwig Maximilians University and quantum cryptography company Qutools, both in Munich, Germany, have shown that Eve might be able to write Alice and Bob's secret key herself.

She can do this by exploiting the fact that, in most QKD systems, the detectors are only active for short periods beginning just before Alice sends each photon. If a photon is received outside this window, it won't register on Bob's readout. By sending a small pulse of light in these gaps, Eve can temporarily blind three of the four receivers just before Alice sends each signal, without being detected. If Bob then registers a photon, Eve can be sure it arose from the remaining detector. Otherwise, the photon will have been "lost" and Bob will record nothing. By repeating this process, Eve can dictate exactly which digits the key will include (*New Journal of Physics*, vol 13, p 73024). "We just manipulate the detectors so that we know which of them is capable of making a click, and therefore which bit will be generated by Bob's receiver," says Weinfurter.

A team led by Hoi-Kwong Lo at the University of Toronto in Canada has developed a third approach that exploits the way in which Alice prepares her signal. In commercial QKD systems, Bob first sends a precisely timed light pulse to Alice, who then encodes the signal using a device called a phase modulator and sends it back to Bob. When Alice expects to receive a signal from Bob, she simply switches on the phase modulator to encode the signal, and then switches it off again.

However, if Eve alters the timing of Bob's initial pulse, for instance by simply shortening or lengthening the fibre-optic cable that connects him to Alice, she can ensure that the signal arrives slightly earlier or later than expected. This introduces slight errors into Alice's encoding, which Eve can then use to mask the disturbance she creates in snooping on the signal sent from Alice to Bob (*New Journal of Physics*, vol 12, p 113026).

These attacks have triggered a debate among quantum cryptographers. Some, like Andrew Shields of Toshiba Research Europe's Cambridge Research Laboratory, are unconvinced they would ever pose a real threat. He thinks Makarov's results may be down to an unnecessary resistor in the single-photon receivers, which seemed to allow the blinding attack to occur. Toshiba's setup doesn't include this resistor, meaning it is immune to these attacks. What's more, the team found that blinding only works if the detector's discrimination level is set too high. This renders it insensitive to the bright pulses used in the attack. "If the discrimination level is properly set, the bright pulses will trigger errors that alert the QKD users to the attack," he says. "Makarov's work is valuable in showing a potential pitfall, but if the QKD system were used in real life it wouldn't be set up in that way." A Magiq Technologies spokesperson agrees, saying Makarov's experiment was not implemented in the way they advise for their commercial customers.

Makarov counters that the ID Quantique commercial system the team cracked in 2010 was shipped to customers with the "unnecessary" resistor soldered to its circuit board - a fact that Gisin, who is also a board member of ID Quantique, confirms, though he says this has been fixed in the latest version of the system. Makarov adds that it was also shipped with the high discrimination level pre-programmed. "Neither did we change the research system in Singapore," he says. "It had been used in several demonstrations by the time we came to hack it."

Cat-and-mouse games

Makarov and his team also disagree with Shields over how best to defend QKD systems against attacks. According to Shields, the blinding attacks generate a large photocurrent, so to unveil the hacker all you need to do is monitor the detector for unusually high levels of photocurrent.

But Lars Lydersen, also of the quantum hacking group at the Norwegian University of Science and Technology, argues that simply developing patches against particular attacks in this way will create an ongoing cat-and-mouse game with attackers, not unlike the one challenging conventional cryptographers. "It's like locking your door and keeping your key under the doormat, then one day you realise someone knows your key is there, so you put it under the garage door," he says.

Instead, Lydersen believes a better option would be to design QKD systems so that they regularly check themselves to ensure they are operating correctly. "So one part of the solution is to have a calibrated light source - like a laser - within the box containing the detectors, and you occasionally turn on the light to check your detectors are actually detecting single photons."

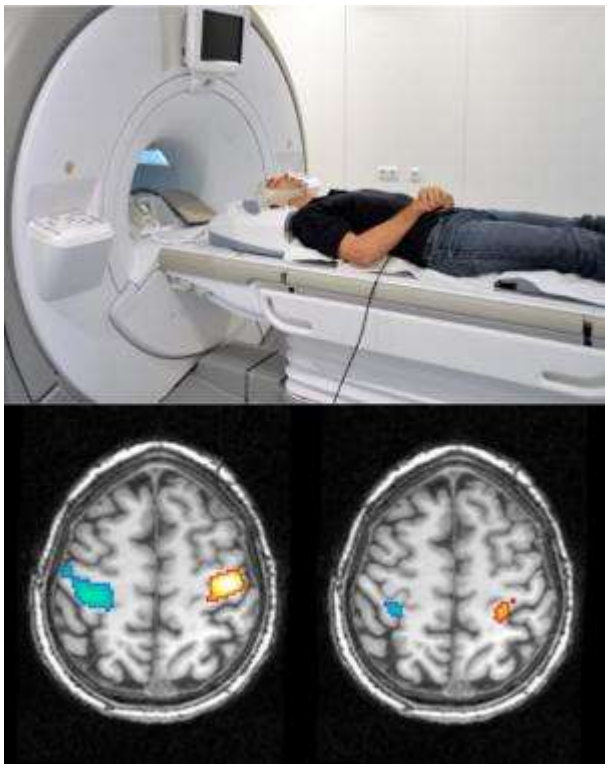
In the end, the attacks and the ensuing debate can only be good news for the security of QKD technology, says Valerio Scarani of the Centre for Quantum Technologies at the National University of Singapore, who was not involved in the experiments. "It's a natural step in the maturation of a field," he says. "First of all there is enthusiasm, then people start being a bit more prudent, and begin to look for problems so they can be fixed."

He adds, however, that the attacks would have made less of a splash if quantum cryptographers had been more modest from the beginning. In the same way that the Titanic taught us that no ship is ever "unsinkable", the attacks demonstrate that no technology, however smart, will ever be truly safe from Eve and her cronies.

Helen Knight *is a writer based in London*

http://www.newscientist.com/article/mg21228352.800-quantum-hackers-cracking-the-uncrackable-code.html?full=true&print=true

Scientists Measure Dream Content for the First Time: Dreams Activate the Brain in a Similar Way to Real Actions



Top: Patient in a functional magnetic resonance imaging machine. Bottom: Activity in the motor cortex during the movement of the hands while awake (left) and during a dreamed movement (right). Blue areas indicate the activity during a movement of the right hand, which is clearly demonstrated in the left brain hemisphere, while red regions indicate the corresponding left-hand movements in the opposite brain hemisphere. (Credit: © MPI of Psychiatry)

ScienceDaily (Oct. 28, 2011) — The ability to dream is a fascinating aspect of the human mind. However, how the images and emotions that we experience so intensively when we dream form in our heads remains a mystery. Up to now it has not been possible to measure dream content. Max Planck scientists working with colleagues from the Charité hospital in Berlin have now succeeded, for the first time, in analysing the activity of the brain during dreaming.

They were able to do this with the help of lucid dreamers, i.e. people who become aware of their dreaming state and are able to alter the content of their dreams. The scientists measured that the brain activity during the dreamed motion matched the one observed during a real executed movement in a state of wakefulness.

The research is published in the journal *Current Biology*.

Methods like functional magnetic resonance imaging have enabled scientists to visualise and identify the precise spatial location of brain activity during sleep. However, up to now, researchers have not been able to analyse specific brain activity associated with dream content, as measured brain activity can only be traced back to a specific dream if the precise temporal coincidence of the dream content and measurement is known. Whether a person is dreaming is something that could only be reported by the individual himself.

Scientists from the Max Planck Institute of Psychiatry in Munich, the Charité hospital in Berlin and the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig availed of the ability of lucid dreamers to dream consciously for their research. Lucid dreamers were asked to become aware of their dream while sleeping in a magnetic resonance scanner and to report this "lucid" state to the researchers by means of eye movements. They were then asked to voluntarily "dream" that they were repeatedly clenching first their right fist and then their left one for ten seconds.

This enabled the scientists to measure the entry into REM sleep -- a phase in which dreams are perceived particularly intensively -- with the help of the subject's electroencephalogram (EEG) and to detect the beginning of a lucid phase. The brain activity measured from this time onwards corresponded with the arranged "dream" involving the fist clenching. A region in the sensorimotor cortex of the brain, which is responsible for the execution of movements, was actually activated during the dream. This is directly comparable with the brain activity that arises when the hand is moved while the person is awake. Even if the lucid dreamer just imagines the hand movement while awake, the sensorimotor cortex reacts in a similar way.

The coincidence of the brain activity measured during dreaming and the conscious action shows that dream content can be measured. "With this combination of sleep EEGs, imaging methods and lucid dreamers, we can measure not only simple movements during sleep but also the activity patterns in the brain during visual dream perceptions," says Martin Dresler, a researcher at the Max Planck Institute for Psychiatry.

The researchers were able to confirm the data obtained using MR imaging in another subject using a different technology. With the help of near-infrared spectroscopy, they also observed increased activity in a region of the brain that plays an important role in the planning of movements. "Our dreams are therefore not a 'sleep cinema' in which we merely observe an event passively, but involve activity in the regions of the brain that are relevant to the dream content," explains Michael Czisch, research group leader at the Max Planck Institute for Psychiatry.

Story Source:

The above story is reprinted from materials provided by **Max-Planck-Gesellschaft**.

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Journal Reference:

1. Martin Dresler, Stefan P. Koch, Renate Wehrle, Victor I. Spoormaker, Florian Holsboer, Axel Steiger, Philipp G. Sämann, Hellmuth Obrig, Michael Czisch. **Dreamed Movement Elicits Activation in the Sensorimotor Cortex**. *Current Biology*, Published online Oct. 27, 2011 DOI: 10.1016/j.cub.2011.09.029

http://www.sciencedaily.com/releases/2011/10/111028113626.htm

The world at seven billion

As the world population reaches seven billion people, the BBC's Mike Gallagher asks whether efforts to control population have been, as some critics claim, a form of authoritarian control over the world's poorest citizens.

The temperature is some 30C. The humidity stifling, the noise unbearable. In a yard between two enormous tea-drying sheds, a number of dark-skinned women patiently sit, each accompanied by an unwieldy looking cloth sack. They are clad in colourful saris, but look tired and shabby. This is hardly surprising - they have spent most of the day in nearby plantation fields, picking tea that will net them around two cents a kilo - barely enough to feed their large families.

Vivek Baid thinks he knows how to help them. He runs the Mission for Population Control, a project in eastern India which aims to bring down high birth rates by encouraging local women to get sterilised after their second child.

As the world reaches an estimated seven billion people, people like Vivek say efforts to bring down the world's population must continue if life on Earth is to be sustainable, and if poverty and even mass starvation are to be avoided.

There is no doubting their good intentions. Vivek, for instance, has spent his own money on the project, and is passionate about creating a brighter future for India.

But critics allege that campaigners like Vivek - a successful and wealthy male businessman - have tended to live very different lives from those they seek to help, who are mainly poor women.

These critics argue that rich people have imposed population control on the poor for decades. And, they say, such coercive attempts to control the world's population often backfired and were sometimes harmful.

Population scare

Most historians of modern population control trace its roots back to the Reverend Thomas Malthus, an English clergyman born in the 18th Century who believed that humans would always reproduce faster than Earth's capacity to feed them.

Giving succour to the resulting desperate masses would only imperil everyone else, he said. So the brutal reality was that it was better to let them starve.

'Plenty is changed into scarcity'

From Thomas Malthus' Essay on Population, 1803 edition:

A man who is born into a world already possessed - if he cannot get subsistence from his parents on whom he has a just demand, and if the society do not want his labour, has no claim of right to the smallest portion of food.

At nature's mighty feast there is no vacant cover for him. She tells him to be gone, and will quickly execute her own orders, if he does not work upon the compassion of some of her guests. If these guests get up and make room for him, other intruders immediately appear demanding the same favour. The plenty that before reigned is changed into scarcity; and the happiness of the guests is destroyed by the spectacle of misery and dependence in every part of the hall.

Rapid agricultural advances in the 19th Century proved his main premise wrong, because food production generally more than kept pace with the growing population.

But the idea that the rich are threatened by the desperately poor has cast a long shadow into the 20th Century.

From the 1960s, the World Bank, the UN and a host of independent American philanthropic foundations, such as the Ford and Rockefeller foundations, began to focus on what they saw as the problem of burgeoning Third World numbers.

The believed that overpopulation was the primary cause of environmental degradation, economic underdevelopment and political instability.

Massive populations in the Third World were seen as presenting a threat to Western capitalism and access to resources, says Professor Betsy Hartmann of Hampshire College, Massachusetts, in the US.

"The view of the south is very much put in this Malthusian framework. It becomes just this powerful ideology," she says.

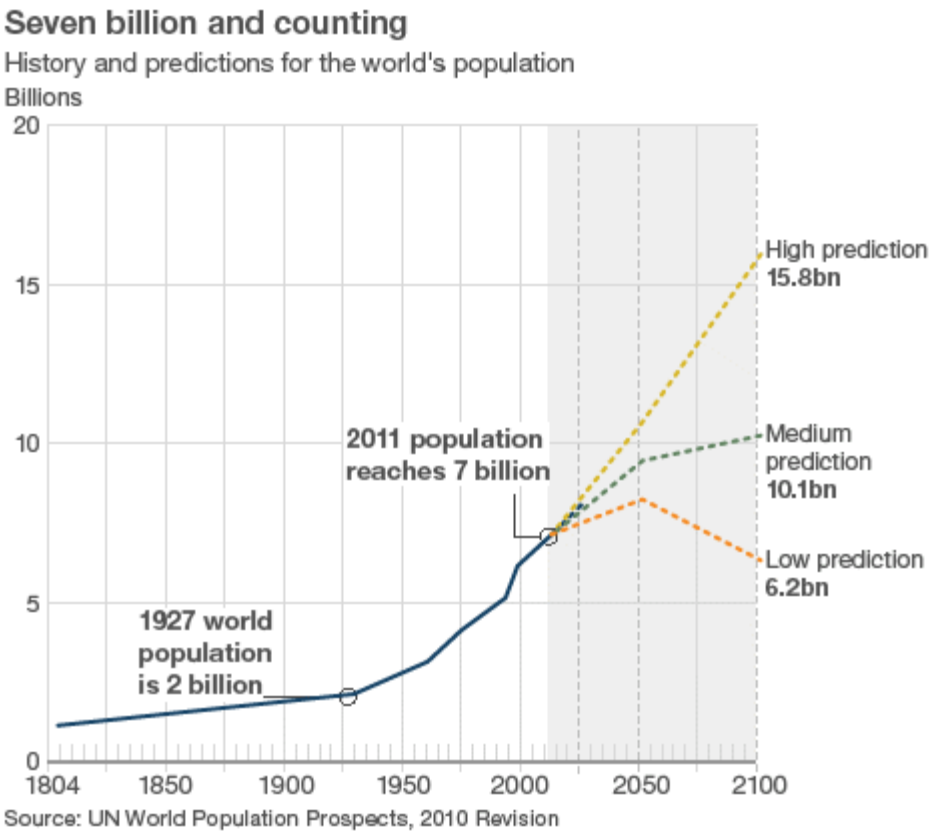
In 1966, President Lyndon Johnson warned that the US might be overwhelmed by desperate masses, and he made US foreign aid dependent on countries adopting family planning programmes.

Other wealthy countries such as Japan, Sweden and the UK also began to devote large amounts of money to reducing Third World birth rates.

'Unmet need'

What virtually everyone agreed was that there was a massive demand for birth control among the world's poorest people, and that if they could get their hands on reliable contraceptives, runaway population growth might be stopped.

But with the benefit of hindsight, some argue that this so-called unmet need theory put disproportionate emphasis on birth control and ignored other serious needs.



"It was a top-down solution," says Mohan Rao, a doctor and public health expert at Delhi's Jawaharlal Nehru University.

"There was an unmet need for contraceptive services, of course. But there was also an unmet need for health services and all kinds of other services which did not get attention. The focus became contraception."

Had the demographic experts worked at the grass-roots instead of imposing solutions from above, suggests Adrienne Germain, formerly of the Ford Foundation and then the International Women's Health Coalition, they might have achieved a better picture of the dilemmas facing women in poor, rural communities.

"Not to have a full set of health services meant women were either unable to use family planning, or unwilling to - because they could still expect half their kids to die by the age of five," she says.

Us and them

India's sterilisation 'madness'

Indira Gandhi and her son Sanjay (above) presided over a mass sterilisation campaign. From the mid-1970s, Indian officials were set sterilisation quotas, and sought to ingratiate themselves with superiors by exceeding them. Stories abounded of men being accosted in the street and taken away for the operation. The head of the World Bank, Robert McNamara, congratulated the Indian government on "moving effectively" to deal with high birth rates. Funding was increased, and the sterilising went on.

In Delhi, some 700,000 slum dwellers were forcibly evicted, and given replacement housing plots far from the city centre, frequently on condition that they were either sterilised or produced someone else for the operation. In poorer agricultural areas, whole villages were rounded up for sterilisation. When residents of one village protested, an official is said to have threatened air strikes in retaliation.

"There was a certain madness," recalls Nina Puri of the Family Planning Association of India. "All rationality was lost."

In 1968, the American biologist Paul Ehrlich caused a stir with his bestselling book, The Population Bomb, which suggested that it was already too late to save some countries from the dire effects of overpopulation, which would result in ecological disaster and the deaths of hundreds of millions of people in the 1970s.

Instead, governments should concentrate on drastically reducing population growth. He said financial assistance should be given only to those nations with a realistic chance of bringing birth rates down. Compulsory measures were not to be ruled out.

Western experts and local elites in the developing world soon imposed targets for reductions in family size, and used military analogies to drive home the urgency, says Matthew Connelly, a historian of population control at Columbia University in New York.

"They spoke of a war on population growth, fought with contraceptive weapons," he says. "The war would entail sacrifices, and collateral damage."

Such language betrayed a lack of empathy with their subjects, says Ms Germain: "People didn't talk about people. They talked of acceptors and users of family planning."

Emergency measures

Critics of population control had their say at the first ever UN population conference in 1974.

Karan Singh, India's health minister at the time, declared that "development is the best contraceptive".

But just a year later, Mr Singh's government presided over one of the most notorious episodes in the history of population control.

In June 1975, the Indian premier, Indira Gandhi, declared a state of emergency after accusations of corruption threatened her government. Her son Sanjay used the measure to introduce radical population control measures targeted at the poor.

The Indian emergency lasted less than two years, but in 1975 alone, some eight million Indians - mainly poor men - were sterilised.

Yet, for all the official programmes and coercion, many poor women kept on having babies.

The BBC's Fergus Walsh finds out whether the numbers will rise or fall in the future

And where they did not, it arguably had less to do with coercive population control than with development, just as Karan Singh had argued in 1974, says historian Matt Connelly.

For example, in India, a disparity in birth rates could already be observed between the impoverished northern states and more developed southern regions like Kerala, where women were more likely to be literate and educated, and their offspring more likely to be healthy.

Women there realised that they could have fewer births and still expect to see their children survive into adulthood.

Total control

By now, this phenomenon could be observed in another country too - one that would nevertheless go on to impose the most draconian population control of all.

China: 'We will not allow your baby to live'

Steven Mosher was a Stanford University anthropologist working in rural China who witnessed some of the early, disturbing moments of Beijing's One Child Policy.

"I remember very well the evening of 8 March, 1980. The local Communist Party official in charge of my village came over waving a government document. He said: 'The Party has decided to impose a cap of 1% on population growth this year.' He said: 'We're going to decide who's going to be allowed to continue their pregnancy and who's going to be forced to terminate their pregnancy.' And that's exactly what they did."

"These were women in the late second and third trimester of pregnancy. There were several women just days away from giving birth. And in my hearing, a party official said: 'Do not think that you can simply wait until you go into labour and give birth, because we will not allow your baby to live. You will go home alone'."

The One Child Policy is credited with preventing some 400 million births in China, and remains in place to this day. In 1983 alone, more than 16 million women and four million men were sterilised, and 14 million women received abortions.

Assessed by numbers alone, it is said to be by far the most successful population control initiative. Yet it remains deeply controversial, not only because of the human suffering it has caused.

A few years after its inception, the policy was relaxed slightly to allow rural couples two children if their first was not a boy. Boy children are prized, especially in the countryside where they provide labour and care for parents in old age.

But modern technology allows parents to discover the sex of the foetus, and many choose to abort if they are carrying a girl. In some regions, there is now a serious imbalance between men and women.

Moreover, since Chinese fertility was already in decline at the time the policy was implemented, some argue that it bears less responsibility for China's falling birth rate than its supporters claim.

"I don't think they needed to bring it down further," says Indian demographer AR Nanda. "It would have happened at its own slow pace in another 10 years."

Backlash

In the early 1980s, objections to the population control movement began to grow, especially in the United States.

In Washington, the new Reagan administration removed financial support for any programmes that involved abortion or sterilisation.

"Start Quote

if you give women the tools they need - education, employment, contraception, safe abortion - then they will make the choices that benefit society"

Adrienne Germain

The broad alliance to stem birth rates was beginning to dissolve and the debate become more polarised along political lines.

While some on the political right had moral objections to population control, some on the left saw it as neo-colonialism.

Faith groups condemned it as a Western attack on religious values, but women's groups feared changes would mean poor women would be even less well-served.

By the time of a major UN conference on population and development in Cairo in 1994, women's groups were ready to strike a blow for women's rights, and they won.

The conference adopted a 20-year plan of action, known as the Cairo consensus, which called on countries to recognise that ordinary women's needs - rather than demographers' plans - should be at the heart of population strategies.

After Cairo

Today's record-breaking global population hides a marked long-term trend towards lower birth rates, as urbanisation, better health care, education and access to family planning all affect women's choices.

With the exception of sub-Saharan Africa and some of the poorest parts of India, we are now having fewer children than we once did - in some cases, failing even to replace ourselves in the next generation. And although total numbers are set to rise still further, the peak is now in sight.

China promoted birth control before implementing its one-child policy

Assuming that this trend continues, total numbers will one day level off, and even fall. As a result, some believe the sense of urgency that once surrounded population control has subsided.

The term population control itself has fallen out of fashion, as it was deemed to have authoritarian connotations. Post-Cairo, the talk is of women's rights and reproductive rights, meaning the right to a free choice over whether or not to have children.

According to Adrienne Germain, that is the main lesson we should learn from the past 50 years.

"I have a profound conviction that if you give women the tools they need - education, employment, contraception, safe abortion - then they will make the choices that benefit society," she says.

"If you don't, then you'll just be in an endless cycle of trying to exert control over fertility - to bring it up, to bring it down, to keep it stable. And it never comes out well. Never."

Nevertheless, there remain to this day schemes to sterilise the less well-off, often in return for financial incentives. In effect, say critics, this amounts to coercion, since the very poor find it hard to reject cash.

"The people proposing this argue 'Don't worry, everything' s fine now we have voluntary programmes on the Cairo model'," says Betsy Hartmann.

"But what they don't understand is the profound difference in power between rich and poor. The people who provide many services in poor areas are already prejudiced against the people they serve."

Work in progress

For Mohan Rao, it is an example of how even the Cairo consensus fails to take account of the developing world.

"Cairo had some good things," he says. "However Cairo was driven largely by First World feminist agendas. Reproductive rights are all very well, but [there needs to be] a whole lot of other kinds of enabling rights before women can access reproductive rights. You need rights to food, employment, water, justice and fair wages. Without all these you cannot have reproductive rights."

Perhaps, then, the humanitarian ideals of Cairo are still a work in progress.

Meanwhile, Paul Ehrlich has also amended his view of the issue.

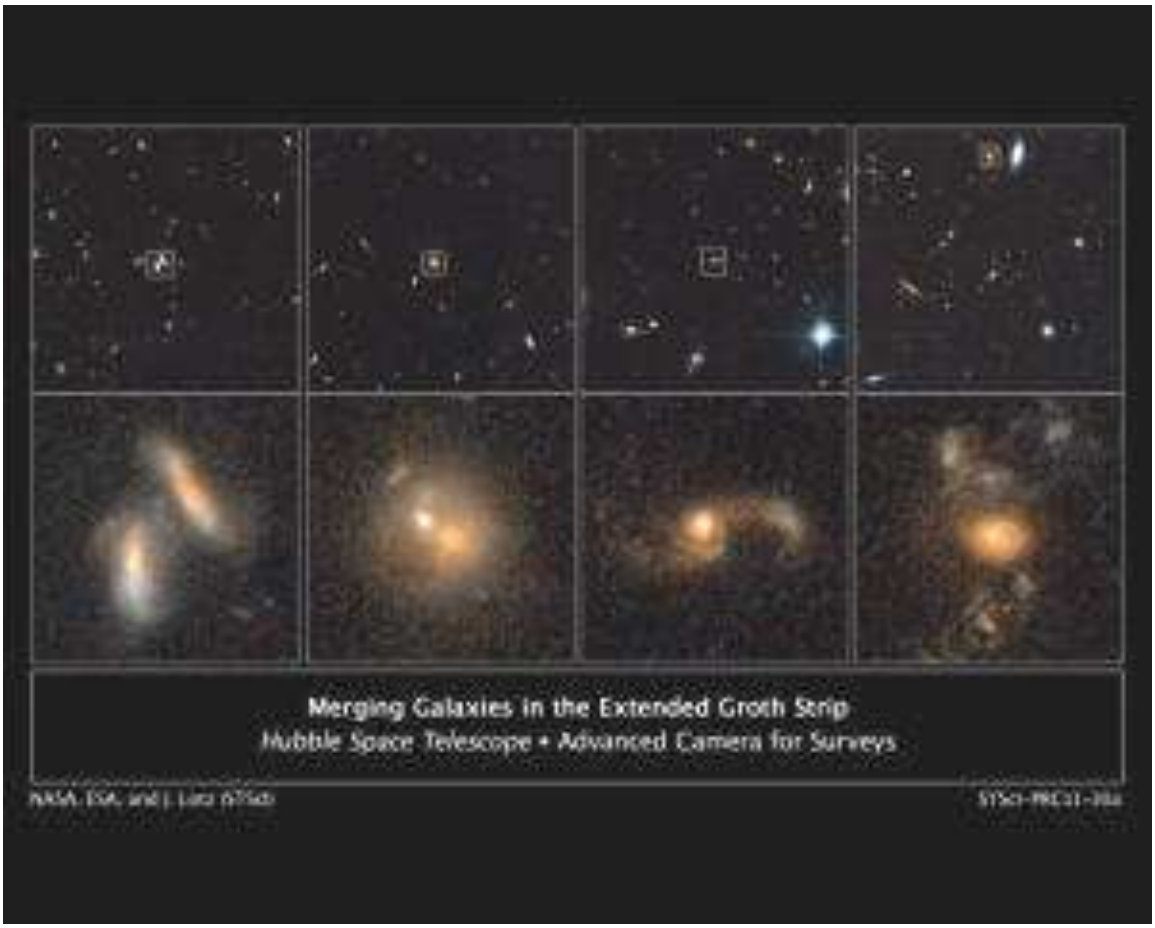
If he were to write his book today, "I wouldn't focus on the poverty-stricken masses", he told the BBC.

"I would focus on there being too many rich people. It's crystal clear that we can't support seven billion people in the style of the wealthier Americans."

Mike Gallager is the producer of the radio programme Controlling People *on BBC World Service*

http://www.bbc.co.uk/news/magazine-15449959

Astronomers Pin Down Galaxy Collision Rate With Hubble Data



Galactic Wrecks Far from Earth: These images from NASA's Hubble Space Telescope's ACS in 2004 and 2005 show four examples of interacting galaxies far away from Earth. The galaxies, beginning at far left, are shown at various stages of the merger process. The top row displays merging galaxies found in different regions of a large survey known as the AEGIS. More detailed views are in the bottom row of images. (Credit: NASA; ESA; J. Lotz, STScI; M. Davis, University of California, Berkeley; and A. Koekemoer, STScI)

ScienceDaily (Oct. 27, 2011) — A new analysis of Hubble surveys, combined with simulations of galaxy interactions, reveals that the merger rate of galaxies over the last 8 billion to 9 billion years falls between the previous estimates.

The galaxy merger rate is one of the fundamental measures of galaxy evolution, yielding clues to how galaxies bulked up over time through encounters with other galaxies. And yet, a huge discrepancy exists over how often galaxies coalesced in the past. Measurements of galaxies in deep-field surveys made by NASA's Hubble Space Telescope generated a broad range of results: anywhere from 5 percent to 25 percent of the galaxies were merging.

The study, led by Jennifer Lotz of the Space Telescope Science Institute in Baltimore, Md., analyzed galaxy interactions at different distances, allowing the astronomers to compare mergers over time. Lotz's team found that galaxies gained quite a bit of mass through collisions with other galaxies. Large galaxies merged with each other on average once over the past 9 billion years. Small galaxies were coalescing with large galaxies more frequently. In one of the first measurements of smashups between dwarf and massive galaxies in the

distant universe, Lotz's team found these mergers happened three times more often than encounters between two hefty galaxies.

"Having an accurate value for the merger rate is critical because galactic collisions may be a key process that drives galaxy assembly, rapid star formation at early times, and the accretion of gas onto central supermassive black holes at the centers of galaxies," Lotz explains.

The team's results are accepted for publication appeared in *The Astrophysical Journal*.

The problem with previous Hubble estimates is that astronomers used different methods to count the mergers.

"These different techniques probe mergers at different 'snapshots' in time along the merger process," Lotz says. "It is a little bit like trying to count car crashes by taking snapshots. If you look for cars on a collision course, you will only see a few of them. If you count up the number of wrecked cars you see afterwards, you will see many more. Studies that looked for close pairs of galaxies that appeared ready to collide gave much lower numbers of mergers than those that searched for galaxies with disturbed shapes, evidence that they're in smashups."

To figure out how many encounters happen over time, Lotz needed to understand how long merging galaxies would look like "wrecks" before they settle down and begin to look like normal galaxies again.

That's why Lotz and her team turned to highly detailed computer simulations to help make sense of the Hubble photographs. The team made simulations of the many possible galaxy collision scenarios and then mapped them to Hubble images of galaxy interactions.

Creating the computer models was a time-consuming process. Lotz's team tried to account for a broad range of merger possibilities, from a pair of galaxies with equal masses joining together to an interaction between a giant galaxy and a puny one. The team also analyzed different orbits for the galaxies, possible collision impacts, and how galaxies were oriented to each other. In all, the group came up with 57 different merger scenarios and studied the mergers from 10 different viewing angles. "Viewing the simulations was akin to watching a slow-motion car crash," Lotz says.

The simulations followed the galaxies for 2 billion to 3 billion years, beginning at the first encounter and continuing until the union was completed, about a billion years later.

"Our simulations offer a realistic picture of mergers between galaxies," Lotz says.

In addition to studying the smashups between giant galaxies, the team also analyzed encounters among puny galaxies. Spotting collisions with small galaxies are difficult because the objects are so dim relative to their larger companions.

"Dwarf galaxies are the most common galaxy in the universe," Lotz says. "They may have contributed to the buildup of large galaxies. In fact, our own Milky Way galaxy had several such mergers with small galaxies in its recent past, which helped to build up the outer regions of its halo. This study provides the first quantitative understanding of how the number of galaxies disturbed by these minor mergers changed with time."

Lotz compared her simulation images with pictures of thousands of galaxies taken from some of Hubble's largest surveys, including the All-Wavelength Extended Groth Strip International Survey (AEGIS), the Cosmological Evolution Survey (COSMOS), and the Great Observatories Origins Deep Survey (GOODS), as well as mergers identified by the DEEP2 survey with the W.M. Keck Observatory in Hawaii. She and other

groups had identified about a thousand merger candidates from these surveys but initially found very different merger rates.

"When we applied what we learned from the simulations to the Hubble surveys in our study, we derived much more consistent results," Lotz says.

Her next goal is to analyze galaxies that were interacting around 11 billion years ago, when star formation across the universe peaked, to see if the merger rate rises along with the star formation rate. A link between the two would mean galaxy encounters incite rapid star birth.

In addition to Lotz, the coauthors of the paper include Patrik Jonsson of Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass; T. J. Cox of Carnegie Observatories in Pasadena, Calif.; Darren Croton of the Centre for Astrophysics and Supercomputing at Swinburne University of Technology in Hawthorn, Australia; Joel R. Primack of the University of California, Santa Cruz; Rachel S. Somerville of the Space Telescope Science Institute and The Johns Hopkins University in Baltimore, Md.; and Kyle Stewart of NASA's Jet Propulsion Laboratory in Pasadena, Calif.

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency. NASA's Goddard Space Flight Center manages the telescope. The Space Telescope Science Institute (STScI) conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy, Inc., in Washington, D.C.

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Love letter to a painting
Theodore K. Rabb

Carola Hicks
GIRL IN A GREEN GOWN
The history and mystery of the Arnolfini portrait
257pp. Chatto and Windus. £16.99.
978 0 701 18337 0
Published: 26 October 2011

T his book is a love letter to a painting. Like many love letters, it has a melancholy air – in this case because it was written just before the author died, and had to be completed and seen through the press by her husband. But the strength of the passion for one of Britain's favourite works of art is unmistakable, especially when this academic art historian scolds her colleagues for "untangling its meaning, rather than just enjoying it". Inevitably, in the course of more than 200 pages, Carola Hicks invests what she calls "the Arnolfini portrait" with a great deal of meaning, and explains at some length what Jan Van Eyck was trying to do when he painted it. Even as she dismisses alternative interpretations, however, she keeps reminding us of the exquisite mastery and the profound influence exhibited by this little wooden panel, measuring less than 2 feet by 3.

There are two main themes that Hicks pursues. Going much further than predecessors such as Craig Harbison (in Jan Van Eyck: The play of realism, 1991), she delves into the material world that is reflected in the many objects in the painting. If you want to know what the "dagging" of a fabric requires, how "crown glass" is made, or what was involved when the huchiers made a banc à perche, this is the book for you. There is an affectionate recreation of the crafts and the rare and fine goods that were available to a couple as rich as the Arnolfini, established as they were at the upper levels of the social hierarchy. To make these descriptions as concrete as she can, Hicks situates them firmly in context, explaining what was available in Bruges, the city where the picture was produced. Thus we discover the source of the fur that lines the woman's underdress (pured minever or lettice from local squirrels) and the quite different fur (pine marten from Russia or

Scandinavia) that is visible around the man's gown. The portrait becomes a cornucopia of earthly delights – costly stuffs and sumptuous things, brought from far and near.

The second major theme is provenance. As Hicks points out, one of the remarkable features of the panel is its pedigree, for we have a good idea of who owned it, and where it was, from the day it was finished in 1434 down to our own times. Its history is not without adventure, and certainly hazardous moments, as it travelled over land and sea, escaped burning, and even survived a battle and disposition by soldiers after the fighting ended. Hicks recounts this history with aplomb, together with sketches of the owners and tales of the negotiations as the painting changed hands.

a superb experience is in store for anyone who stands in front of the panel and revels in its mastery of colour, of light, and of detail

The one owner who gets less than his due is Philip II of Spain, whose interests are described in terms merely of his piety and his Habsburg inheritance. But the nudes the King commissioned from Titian, and the many other examples of his tastes, mark him as probably the most discriminating connoisseur to have owned the Van Eyck. The Spanish devotion to Netherlandish art, moreover, long pre-dated any political or dynastic interest. Queen Isabella's father, John II, was already a collector, as were other patrons who sought goods from the north at the Medina del Campo fairs. There are over a thousand Flemish pictures in the Prado, and many examples of Hispano-Flemish architecture from the fifteenth century. Those connections alone should have precluded this verdict on Spaniards in a sentence about Hieronymus Bosch: "The artist's combination of grotesquerie with medieval Christian symbolism, his way of blending sensuality with pain, and the surreal conjunction of fantastic and microscopically accurate landscape epitomized the distinctive Spanish character and the fanatic power of Spanish religion".

The two themes provide the backbone of the book, and generate a lively narrative that brings one from fifteenth-century Flanders to the present day. The only difficulty is that Hicks decided to interweave the two together. Thus a chapter on the painting's furniture comes between chapters on two successive owners, Marguerite of Austria and Marie of Hungary. And the jumping back and forth continues to the end of the nineteenth century. A chapter entitled "The Dog" divides even the period after 1842, when the Van Eyck found the home it has kept ever since, London's National Gallery. The effect is to interrupt the flow, to cause threads to be lost, and to blur the overall narrative as attention switches from one kind of analysis to another.

It is only in the last two chapters that Hicks takes up the question of what the painting is about. Her emphasis on the material goods in the Arnolfini room makes clear her own focus: that this is a celebration of the wealth and possessions of a prominent merchant. As for other interpretations, she suggests that the spate of scholarly quests for symbolic or other meanings has led to "many misunderstandings", and she pays them little notice beyond indicating some of their shortcomings. It is fair enough to argue that a superb experience is in store for anyone who stands in front of the panel and revels in its mastery of colour, of light, and of detail. Yet an overall assessment of the artist's aims, beyond the depiction of everyday objects, would surely have enhanced the pleasure of the general reader for whom this book is written.

That is not to say that Hicks herself eschews the wider references the painting implies. She explains the presence of the oranges, for instance, by citing the contemporary theory that they were "Adam's apples", and possibly the fruit on the tree of knowledge in the garden of Eden. Repeatedly, too, she notes the analogies in the picture to the attributes of the Virgin Mary, one of Van Eyck's favourite subjects. But she firmly resists the notion, first put forward in the 1930s, in a famous article by Erwin Panofsky, that there might be an underlying theme that animates the array of unusual details in the panel. For Panofsky it was the sacrament of marriage, evidenced by a multitude of objects, from the figure of St Margaret, patron saint of childbirth, carved on the bedpost, to the couple's hand-holding and the single lit candle (a feature of the marriage ceremony) in the candelabrum. Though some of the connections were challenged, the two pages Panofsky

devoted to the painting twenty years later, in his Early Netherlandish Painting (1953), still manage to give Van Eyck a purpose that elevates the immediate celebration of a rich man and his possessions.

Hicks hesitates to offer any such broad understanding. Yet one has to wonder whether her insistence that a bed was a feature of presentation rooms (which is how she describes the Arnolfini chamber) might not be tempered by a recognition that its appearance was a feature of scenes in presentation rooms that celebrated a marriage. Along similar lines, she describes Arnolfini's raised hand as a greeting to the two visitors reflected in the concave mirror, even though his palm is directed at his wife, which is far more likely to mean that the gesture is directed as a salutation or blessing to her (emphasizing the connection between them) rather than to the visitors. And Hicks seems deliberately to avoid mentioning the symbolisms that were common in the art of the day: the dog as a token of fidelity, or the discarded shoes that marked a holy place (echoing God's command to Moses at the burning bush).

Although arguments over specific references – such as whether the woman is pregnant – may never be resolved, there seems little doubt that this is a painting about a sanctified relationship, and not simply a portrait of a couple. That perception not only aids understanding, but also enriches the enjoyment of Van Eyck's achievement. How vivid it all seems, and yet how powerful is the basic message about the sacrament of marriage.

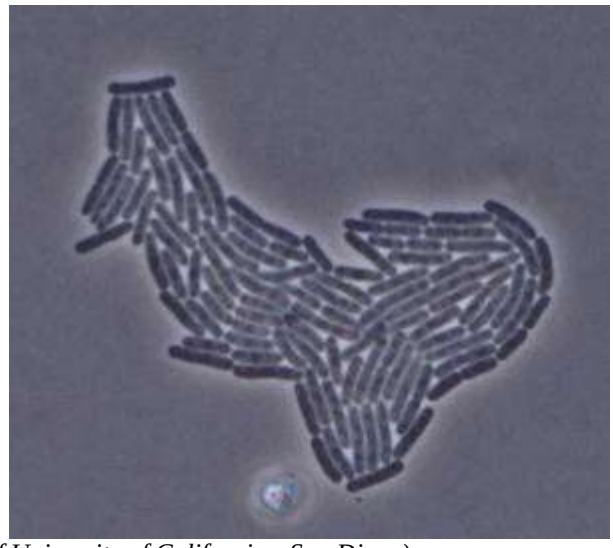
Hicks abjures this approach to the painting, focusing instead, in her concluding pages, on the impact it has had on the arts since going on public display in 1842. This is a masterly account, ranging from the Pre-Raphaelites to Tracey Emin, and encompassing advertising, cartoons and souvenirs as well as more serious endeavours. It is here, however, that one becomes aware of how poorly Hicks has been served by the book's illustrations. In the early chapters, they are small, dark, and largely unhelpful. It is almost impossible, for instance, to read the inscription in the portrait of Marie of Hungary. A section of colour reproductions is better, but still too small to help with details. Because the text lacks cross-references, one is disappointed when, stirred by a vivid description of a homage to Van Eyck by David Hockney in his "Mr and Mrs Clark and Percy", one turns to the colour illustrations for illumination, only to find a painting by Benjamin Sullivan that is deemed beguiling but is otherwise not explored.

The shortcomings of the illustrations are especially regrettable in that they could have done much to help Hicks make her points. Again and again, the arguments would have been easier to follow if there had been sizeable reproductions of the details in the painting, let alone of other Van Eycks that bear on her subject – the Berlin portrait of Arnolfini, the various portrayals of the Virgin (notably with Chancellor Rolin), and details from the Ghent altarpiece, all of which figure in the analysis. Even without such assistance, however, this beautifully written book is a splendid testament to the intelligence, attention to detail, depth of research, and down-to-earth vision of a first-rate scholar.

Theodore K. Rabb is Emeritus Professor of History at Princeton University. His new book, The Artist and the Warrior, is due to be published next month.

http://www.the-tls.co.uk/tls/public/article807103.ece

Do Bacteria Age? Biologists Discover the Answer Follows Simple Economics



Colony of E. coli bacteria. (Credit: Image courtesy of University of California - San Diego)

ScienceDaily (Oct. 27, 2011) — When a bacterial cell divides into two daughter cells and those two cells divide into four more daughters, then 8, then 16 and so on, the result, biologists have long assumed, is an eternally youthful population of bacteria. Bacteria, in other words, don't age -- at least not in the same way all other organisms do.

But a study conducted by evolutionary biologists at the University of California, San Diego questions that longstanding paradigm. In a paper published in the November 8 issue of the journal *Current Biology*, they conclude that not only do bacteria age, but that their ability to age allows bacteria to improve the evolutionary fitness of their population by diversifying their reproductive investment between older and more youthful daughters. An advance copy of the study appears this week in the journal's early online edition.

"Aging in organisms is often caused by the accumulation of non-genetic damage, such as proteins that become oxidized over time," said Lin Chao, a professor of biology at UC San Diego who headed the study. "So for a single celled organism that has acquired damage that cannot be repaired, which of the two alternatives is better -- to split the cellular damage in equal amounts between the two daughters or to give one daughter all of the damage and the other none?"

The UC San Diego biologists' answer -- that bacteria appear to give more of the cellular damage to one daughter, the one that has "aged," and less to the other, which the biologists term "rejuvenation" -- resulted from a computer analysis Chao and colleagues Camilla Rang and Annie Peng conducted on two experimental studies. Those studies, published in 2005 and 2010, attempted unsuccessfully to resolve the question of whether bacteria aged. While the 2005 study showed evidence of aging in bacteria, the 2010 study, which used a more sophisticated experimental apparatus and acquired more data than the previous one, suggested that they did not age.

"We analyzed the data from both papers with our computer models and discovered that they were really demonstrating the same thing," said Chao. "In a bacterial population, aging and rejuvenation goes on simultaneously, so depending on how you measure it, you can be misled to believe that there is no aging."

In a separate study, the UC San Diego biologists filmed populations of *E. coli* bacteria dividing over hundreds of generations and confirmed that the sausage-shaped bacteria divided each time into daughter cells that grew elongated at different rates -- suggesting that one daughter cell was getting all or most of the cellular damage from its mother while the other was getting little or none. Click this link to watch the time-lapse film of one bacterium dividing over 10 generations into 1,000 bacteria in a period of five hours and see if you can see any differences.

"We ran computer models and found that giving one daughter more the damage and the other less always wins from an evolutionary perspective," said Chao. "It's analogous to diversifying your portfolio. If you could invest $1 million at 8 percent, would that provide you with more money than splitting the money and investing $500,000 at 6 percent and $500,000 at 10 percent?"

"After one year it makes no difference," he added. "But after two years, splitting the money into the two accounts earns you more and more money because of the compounding effect of the 10 percent. It turns out that bacteria do the same thing. They give one daughter a fresh start, which is the higher interest-bearing account and the other daughter gets more of the damage."

Although *E. coli* bacteria appear to divide precisely down the middle into two daughter cells, the discovery that the two daughters eventually grow to different lengths suggests that bacteria do not divide as symmetrically as most biologists have come to believe, but that their division is really "asymmetrical" within the cell.

"There must be an active transport system within the bacterial cell that puts the non-genetic damage into one of the daughter cells," said Chao. "We think evolution drove this asymmetry. If bacteria were symmetrical, there would be no aging. But because you have this asymmetry, one daughter by having more damage has aged, while the other daughter gets a rejuvenated start with less damage."

Story Source:

The above story is reprinted from materials provided by **University of California - San Diego**. The original article was written by Kim McDonald.

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Julian Assange's rebellious Life

George Brock

Julian Assange
JULIAN ASSANGE
The unauthorised autobiography
350pp. Canongate. £20.
978 0 85786 384 3

Published: 26 October 2011

" All memoir is prostitution", Julian Assange declared as he withdrew from cooperating with this book's publishers and his ghostwriter. This may be the first hint ever dropped by the founder of WikiLeaks that there can be such a thing as too much publicity. Or it could be an oblique acknowledgement that this autobiography does not meet his wish to be respected as a master of the universe.

Assange did not return several hundred thousand pounds of advance money he had been paid by the publishers. He had given it to lawyers who have been defending him against extradition to Sweden to face rape charges. Canongate's editors, knowing they were damned (when you fall out with Julian Assange, you stay that way), went ahead and published. As a result, this quarrel-amputated book stops suddenly in November 2010, just before the publication of the first American diplomatic cables. Even by the standards of self-vindicating memoirs, the gaps are glaring. Assange flirted with Russian anti-Semites; he has been criticized in formidable detail by his one-time collaborator Daniel Domscheit-Berg; the finances of WikiLeaks remain mysterious. None of this rates a mention.

life had not been normal from the start

The language, often arch and grandiloquent, can slip out of focus. Take this chapter opening: "Disclosure is not merely an action; it is a way of life. To my mind it carries both sense and sensibility: you are what you

know, and no state has the right to make you less than you are". Assange's account of WikiLeaks since it became world-famous does not add a lot to what we already know. The book's most intriguing sections are those on his early life and motives. They help to explain why WikiLeaks has not been the agent of radical change its founders dreamt of.

The tone in which Assange tells his story recasts an eccentric Australian boyhood in heroic terms. He has been a "freedom fighter". In the late 1980s, Assange was a teenage computer hacker who prowled, from his Melbourne bedroom, supposedly secret government servers across the world. Meanwhile, on the other side of the globe, protesters in Germany began risking their lives to bring down the Berlin Wall.

Little did those pastors and peace activists in Dresden and Leipzig realize that work of equal importance was going on in Australia. "We were already changing the world", Assange writes. "When the TVs were switched off, when the parents went to bed, a battalion of young computer hackers were going inside those networks, seeking to create a transformation, I would argue, between information and governance, that would come in time to partner the wallbreakers in their effort to bust the old order."

Assange, operating under the name "Mendax" in a fraternity linked by modems, had made an intoxicating discovery. The systems of big corporations and governments weren't anything like as secure as their architects pretended. Mendax and his friends were very good indeed at infiltrating the networks and they spent happy hours wandering wide-eyed down the forbidden electronic corridors. He hid the really sensitive floppy discs in his beehives in the garden.

But all freedom fighters have enemies. Playing digital hide and seek one night, a systems engineer working for the Canadian telecommunications company Nortel nailed him. The arrival of the police at his home is told in terms designed to remind us of Solzhenitsyn: Assange is reading a volume of prison letters when the knock comes. But the men who arrive are not KGB thugs, but polite policemen led by a sergeant called Ken. And the punishment is not Siberia, but a fine.

Assange's tone when speaking of hacking has a warmth and excitement which is not applied to any humans in his story. His gang of "cypherpunks" were "misfits", he says cheerfully. But other clues are scattered about what misfit actually means. He offhandedly recounts being expelled from a school for hitting a girl with a hammer. He had a son, Daniel, by a woman he lived with. He admits that he was no good at the unglamorous, boring bits of fatherhood. Life in the hacker underground became so absorbing that dull daytime life held no appeal.

But life had not been normal from the start. His mother was a nomadic political activist. The tempo of their frequent moves accelerated when Julian and his mother were stalked from place to place by a malevolent ex-partner of his mother's. Julian attended thirty schools. Affection is largely absent from his story. There is no trace of the idea that in a family a child might learn to trust and negotiate relationships with other people.

Presenting himself then and now as a rebel against the system, Assange is being strictly conventional. What makes him different is the lengths to which he is prepared to go. Two words dominate such arguments as he makes: "power" and "justice". Power is bad. It is wielded by weak, secretive, guilty people who lie and conspire to restrain Assange from doing what is just. Information is the corrective to power – which is always misused – because it brings justice. There is no discussion of the relation between information and truth, no definition of justice and no concession to the idea that human social organization may be hard to achieve without creating sources of power. It is hard to avoid the conclusion that what is just is what Assange says is fair. His defence of WikiLeaks's "editorial judgement" is incoherent and self-contradictory.

When WikiLeaks lands a huge cache of American government documents and is obliged to cooperate with the mainstream media, Assange is rapidly out of his depth. It does not seem to occur to him that media organizations might have aims which differ from his own. He gets very cross.

Assange's querulous, paranoid personality helps to explain why WikiLeaks is part sensation and part tragedy. He and his original colleagues created a watertight platform for leakers: when material was sent there, no one knew where it had come from. This was a truly ground-breaking technical achievement. But, while their understanding of software security was profound, their grasp of politics was weaker. They tried publishing raw material on a website and were bitterly disappointed by the silence. The material was potentially explosive: Kenyan corruption, tax evasion by Swiss banks, manuals from Guantánamo. But banks did not fold; bent politicians were not arrested.

Public reaction was muted partly because the raw material was hard for any reader to digest or often to understand. But, stripped of any authentication, it was also hard to evaluate. The WikiLeakers had inadvertently demonstrated a truth about journalism. For all its faults, mainstream journalism comes with signals, context and history which help a reader or viewer to judge whether to trust what they're reading or seeing.

The American material WikiLeaks was handed was truly significant, but its release did not trigger the political drama Assange expected. An American helicopter crew filmed itself killing civilians, but the wars go on. Assange miscalculated. He overestimated the impact in the US of the revelation that armies are secretive and commit crimes. He was recklessly indifferent to the expertise required to land an information missile on its target. His message was muffled by controversy and divisions inside his own team. The sheer scale of the material diffused the impact of what was disclosed: reactions went in dozens of different directions. For many people, the revelation was the American government's vulnerability: a low level soldier could with ease remove and publicize millions of files.

The consequences of the State Department cables were similarly complex and gradual. They are an archive of unimpeachable value to contemporary historians and probably had some influence in triggering the start of the Arab revolutions in Tunisia. Reverberations have been felt in Ireland, India and Ethiopia. Several American ambassadors have had humiliating apologies to make; one resigned. But the relation between information and governance stands where it did before.

Assange needed allies and expertise. But his inexperience and autocratic impatience drove them away. If the WikiLeaks revelations had been directed by a cohesive group of skilled operators who cooperated to minimize the distractions of an information-saturated world and to make the very strongest moral impact with the powerful data at their disposal, it is likely the world would have taken a different kind of notice. The evidence, not the man, would have been the story.

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http://www.the-tls.co.uk/tls/public/article807082.ece

Researchers Complete Mollusk Evolutionary Tree

Clarity on the mollusk family tree The flamingo tongue snail, Cyphoma gibbosum, is a common and easily recognized gastropod mollusk found in shallow waters of the tropical western Atlantic. It has a bright orange, white, and black pattern on the mantle folds that cover the shell in life. (Credit: Dunn Lab/Brown University)

ScienceDaily (Oct. 26, 2011) — Mollusks have been around for so long (at least 500 million years), are so prevalent on land and in water (from backyard gardens to the deep ocean), and are so valuable to people (clam chowder, oysters on the half shell) that one might assume scientists had learned everything about them.

"Here's this big, diverse group of animals, and we don't know how they were related to each other," said Casey Dunn, an evolutionary biologist at Brown University who specializes in building evolutionary trees. Some branches were well known, Dunn said, "but what we really lacked was a breadth of sampling."

In a paper in *Nature*, researchers from Brown and collaborating institutions have pieced together the most comprehensive phylogeny -- evolutionary tree -- for mollusks. To perform that feat, the team collected hard-to-find specimens through a global sampling effort, including a group of organisms thought until recently to be extinct for millions of years. The team then sequenced thousands of genes from the specimens and matched them up through intensive computational analyses involving the supercomputer at Brown, which the University installed in 2009.

The result: The mollusk phylogeny is now "resolved at a broad scale," said Dunn, assistant professor of biology in the Department of Ecology and Evolutionary Biology and the paper's corresponding author.

The study is noteworthy also because it is the first to place Monoplacophora, the mysterious group of deep-ocean animals that superficially resemble limpets. Scientists had thought the group was extinct until a specimen was caught in 1952 off the coast of Mexico. An expedition in 2007 led by Nerida Wilson, now at the Australian Museum and an author on the current paper, secured a few monoplacophorans off the coast of California. The team extracted the genetic material -- in a one-time-only attempt performed by then-Brown undergraduate Caitlin Feehery -- to obtain the genetic signatures needed to determine how monoplacophorans fit into the mollusk family tree.

The result was surprising: monoplacophorans are a sister clade to cephalopods, which encompasses octopuses, squid, and nautiluses. "Cephalopods are so different from all other mollusks, it was very difficult to understand what they are related to. They don't fit in with the rest," Dunn said. "Now, we have a situation where two of the most enigmatic groups within the mollusks turn out to be sister groups."

In an interesting twist, paleontologists had described the monoplacophoran-cephalopod relationship in the 1970s, resting their claim on evidence that the oldest cephalopods and fossilized monoplacophorans each had chambered shells. Modern-day monoplacophorans still carry shells but no longer have chambers. "When we came in with this genome-level data, we ended up resurrecting this old hypothesis from paleontology," Dunn said. The results from the genetic analysis show the paleontologists were right.

By establishing the close evolutionary relationship between monoplacophorans and cephalopods, the researchers say they have squarely answered the question of a single origin for shelled mollusks. That ancestor species is not known, but the group is confident that monoplacophorans and cephalopods share more in common, evolutionary speaking, with shelled mollusks than with the non-shelled groups aplacophora and polyplacophora.

"What we found is these worm-like mollusks (aplacophora) and chitons (polyplacophora) are more closely related to each other, and they diverged prior to the origin of the shell," Dunn said. "They are mollusks, but they formed this group that split off before shells came along."

In all, the team collected specimens for 15 species. Researchers at Brown and Harvard University sequenced hundreds of thousands of gene sequences and compared those genetic sequences with what is known about the genetic makeup of other species throughout the mollusk tree.

"We are trying to understand how these species are related, their evolutionary relationships. We do this by analyzing the conserved parts of their genomes and constructing an evolutionary tree," said Stephen Smith, a postdoctoral researcher at Brown and the paper's first author, who designed the genetic computational analysis.

Contributing authors include Freya Goetz, Feehery, and Smith at Brown; Wilson from the Australian Museum and the Scripps Institution of Oceanography; Greg Rouse from Scripps; and Sonia Andrade and Gonzalo Giribet from Harvard.

The National Science Foundation, Scripps, the University of California Ship Funds, the Museum of Comparative Zoology, and the Carlsberg Foundation funded the research.

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Is mental time travel what makes us human?

Barbara J. King

Michael C. Corballis
THE RECURSIVE MIND
The origins of human language, thought, and civilization
291pp. Princeton University Press. £20.95 (US $29.95).
978 0 691 14547 1

Published: 26 October 2011

A stonishing animals show up everywhere these days. Cooperative apes, grief-stricken elephants, empathetic cats and dogs crowd our bookshop shelves. It's all the rage to plumb the cognitive and emotional depths of the animal world, rejecting sceptics' sneers of "anthropomorphism" to insist that we're finally coming to see animals for who they really are: not so different from us.

Pushing against this tide of animal awe is a competing cultural trope, the relentless seeking of human superiority. It's from this second camp that Michael C. Corballis, a professor emeritus of psychology from New Zealand, has written The Recursive Mind: The origins of human language, thought, and civilization. Mental time travel and theory of mind, Corballis believes, are two uniquely human ways of thinking that propelled our species to heights above all others, thanks to what is called recursion.

The concept of recursion became an evolutionists' darling largely on the heels of a paper written in 2002 by Marc Hauser, Tecumseh Fitch and Noam Chomsky. That paper, propelled to international notice by the participation of its famous third author, claimed that it's a unique human trick to communicate by embedding structures within other structures, as when one noun phrase in a sentence is made to contain another. An example of such linguistic recursion is furnished by Corballis. The non-recursive sentences "Jane loves John" and "Jane flies aeroplanes" may be combined to produce the recursive sentence "Jane, who flies aeroplanes, loves John". Less interested in language than the mind itself, Corballis states flatly that recursion is "the primary characteristic that distinguishes the human mind from that of other animals".

Here is where mental time travel and theory of mind come in, because both are recursive ways of thinking. During mental time travel, an experience that we've had in the past or that we imagine for ourselves in the future is "inserted into [our] present consciousness". Similarly, in theory of mind, we insert what we believe to be someone else's state of mind into our own.

Corballis is right; we are indeed recursive thinkers. Day by day, if not hour by hour, our kind of animal may soar in memory-flight back in time, or imagine times far ahead. Picture a woman who stares at a summer evening's starry sky, recalling the days long ago when her parents lovingly taught her the names of the constellations. She drifts into a reverie about the years ahead when her children may share star-learning sessions with her, and wonders if her daughter, already addicted to video games, will take to it as readily as her nature-delighted son.

Whether as elaborated as set forth in this hypothetical example or much simpler in content, the human mind's recursive thinking makes us unique in the animal kingdom – or such is Corballis's view. It's a view only as valid as the accompanying comparative analysis of how other species think, and here Corballis falls short.

It is reasonable enough to note, as Corballis does, that recursion developed from "precursors identifiable in nonhuman species". A distinctive quality, after all, can still be rooted in evolutionary antecedents (as religiosity may have deep roots in animal empathy). At one point, Corballis even allows that recursion "was not so much a new faculty as an extension of existing faculties". But familiarity with the primary animal-behaviour literature leads to an alternative conclusion: some non-human animals are conscious selves who plan ahead and who carry out theory of mind thinking in a recursive way.

In 2009, writing in the journal Current Biology, Mathias Osvath described the actions of a male chimpanzee at a Swedish zoo in a way that made international news. In the morning, before visitors were allowed into the zoo, this animal would calmly pile up stones in small caches. He did this only in certain locations of his enclosure, facing the public area, and never when visitors were absent. Several hours after creating a cache, the chimpanzee hurled the stones in an aroused display aimed at the visitors. Osvath concluded that in accumulating the stones, the ape was planning for a future event (that is, the ape inserted an imagined future into its present consciousness).

Yet there is no need to hang the existence of recursion in chimpanzee thinking on a single ape living in captivity. Scientific reports of behaviour by wild chimpanzees include abundant instances of mental time travel and theory of mind. Consider the hunting behaviour described in The Chimpanzees of the Tai Forest by Christophe Boesch and Hedwige Boesch-Achermann (2000). In Ivory Coast, chimpanzees hunt colobus monkeys with true cooperation (rather than through fortuitous timing), and in a significant portion of cases they do so with anticipation. "The hunter", Boesch and Boesch-Achermann write,

"not only has to anticipate the direction in which the prey will flee (recorded as a half anticipation), but also the speed of the prey so as to synchronize his movements to reach the correct height in the tree before the prey enters it (recorded as a full anticipation) . . . . We also recorded a double anticipation when a hunter not only anticipates the actions of the prey, but also the effect the action of other chimpanzees will have on the future movements of the colobus, that is he does not anticipate what he sees (the escaping colobus), but how a future chimpanzee tactic will further influence the escaping monkeys."

Chimpanzee hunting skills in this arena develop gradually in individuals over a twenty-year period of learning. Boesch and Achermann-Boesch discuss these complex behaviours – as well as others, such as the chimpanzees' calculated choice of attack strategies in intergroup encounters – in direct relationship to future planning and theory of mind.

And it is not only the big-brained apes who behave in this way. I wonder if, after viewing the documentary film A Murder of Crows, Corballis would still refuse to credit corvids – ravens and crows – with the recursive

skills already outlined. In one striking scene, a New Caledonian crow (a bird admired by Corballis, though he thinks it incapable of recursive thinking) solves a complex experimental three-part tool-using problem, totally novel to this crow or any other. The bird thinks "three chess moves into the future", as another observer has put it, by problem-solving to find one tool that is used to get another tool that then is finally used to procure food. It is an astonishing performance to watch.

Of course, humans are not crows – or chimpanzees. Scientists should indeed try to understand how the human lineage departed in the past from others and why. It's greatly to Corballis's credit that he rejects theories that purport to explain these events by heavy reliance on genetic mutations or innate brain modules in favour of some degree of mental continuity across species. Corballis even exhibits, now and again, slight unease at his own sharp distinction between the human and non-human. About theory of mind, he allows that "chimpanzees may indeed have some capacity to discern what other individuals can feel, see, and perhaps know". But this is only "first-order" recursion, we are then informed – a surprise move given Corballis's earlier claim that recursion is an absolute species boundary marker. To rescue the principle of human uniqueness, Corballis brings in "higher-order recursion": we alone have "knowledge that another individual knows what I can see, know or feel, or even that the other knows that I know what she's thinking". This shift from recursion to higher-order recursion involves a sleight of hand and undermines the reader's trust.

The situation is not helped by further inaccuracies. Corballis equates a "hunter-gatherer style of living" with "relatively undeveloped technologies". Not necessarily so. Consider the site of Gobekli Tepe in ancient Turkey, a hilltop gathering centre and maybe the world's first temple, constructed from monumental 50-ton blocks covered with animal carvings. This sophisticated structure was created by people with no settlements or domesticated animals or crops – that is, by hunter-gatherers.

Corballis assigns "the development of science and complex manufacture" to "the accomplishments of Western civilization", "generally foreign to indigenous peoples". The long distinguished history of science in the Muslim tradition – and much more besides – is crassly obliterated with this statement. Corballis refers to monkeys and mammals, and then cetaceans and mammals, though monkeys and cetaceans are of course mammals themselves. I cannot fathom the reason behind the statement, "If [wild chimpanzees] survive at all, it will probably be due only to the benevolence of humans", especially given the logging and poaching horrors that Corballis himself mentions in the same paragraph.

Humanity's recursive ways of thinking are more elaborate than those of other animals, but some other animals do think recursively as well. Can the degree of difference explain the origins of human thought, language and civilization? In order to chart a course through this territory, we will require a sharper navigator than Michael Corballis.

Barbara J. King is an anthropologist at the College of William and Mary. She is the author, most recently, of Being With Animals, 2010, and writes the Friday Animal Blog (www.barbarajking.com).

http://www.the-tls.co.uk/tls/public/article807136.ece

Three New Planets and a Mystery Object Discovered Outside Our Solar System

Three planets -- each orbiting its own giant, dying star -- have been discovered by an international research team led by Alex Wolszczan, an Evan Pugh Professor of Astronomy and Astrophysics at Penn State, using the Hobby-Eberly Telescope. Penn State is a major partner in the design, construciton, and operation of this telescope, which is one of the largest in the world. In 1992, Wolszczan became the first astronomer ever to discover planets outside our solar system. (Credit: Marty Harris/McDonald Obs./UT-Austin)

ScienceDaily (Oct. 27, 2011) — Three planets -- each orbiting its own giant, dying star -- have been discovered by an international research team led by a Penn State University astronomer.

Using the Hobby-Eberly Telescope, astronomers observed the planets' parent stars -- called HD 240237, BD +48 738, and HD 96127 -- tens of light years away from our solar system. One of the massive, dying stars has an additional mystery object orbiting it, according to team leader Alex Wolszczan, an Evan Pugh Professor of Astronomy and Astrophysics at Penn State, who, in 1992, became the first astronomer ever to discover planets outside our solar system. The new research is expected to shed light on the evolution of planetary systems around dying stars. It also will help astronomers to understand how metal content influences the behavior of dying stars.

The research will be published in December in the *Astrophysical Journal*. The first author of the paper is Sara Gettel, a graduate student from Penn State's Department of Astronomy and Astrophysics, and the paper is co-authored by three graduate students from Poland.

The three newly-discovered planetary systems are more evolved than our own solar system. "Each of the three stars is swelling and has already become a red giant -- a dying star that soon will gobble up any planet that happens to be orbiting too close to it," Wolszczan said. "While we certainly can expect a similar fate for our own Sun, which eventually will become a red giant and possibly will consume our Earth, we won't have to worry about it happening for another five-billion years." Wolszczan also said that one of the massive, dying stars -- BD +48 738 -- is accompanied not only by an enormous, Jupiter-like planet, but also by a second, mystery object. According to the team, this object could be another planet, a low-mass star, or -- most interestingly -- a brown dwarf, which is a star-like body that is intermediate in mass between the coolest stars and giant planets. "We will continue to watch this strange object and, in a few more years, we hope to be able to reveal its identity," Wolszczan said.

The three dying stars and their accompanying planets have been particularly useful to the research team because they have helped to illuminate such ongoing mysteries as how dying stars behave depending on their metallicity. "First, we know that giant stars like HD 240237, BD +48 738, and HD 96127 are especially noisy. That is, they appear jittery, because they oscillate much more than our own, much-younger Sun. This noisiness disturbs the observation process, making it a challenge to discover any companion planets," Wolszczan said. "Still, we persevered and we eventually were able to spot the planets orbiting each massive star."

Once Wolszczan and his team had confirmed that HD 240237, BD +48 738, and HD 96127 did indeed have planets orbiting around them, they measured the metal content of the stars and found some interesting correlations. "We found a negative correlation between a star's metallicity and its jitteriness. It turns out that the less metal content each star had, the more noisy and jittery it was," Wolszczan explained. "Our own Sun vibrates slightly too, but because it is much younger, its atmosphere is much less turbulent."

Wolszczan also pointed out that, as stars swell to the red-giant stage, planetary orbits change and even intersect, and close-in planets and moons eventually get swallowed and sucked up by the dying star. For this reason, it is possible that HD 240237, BD +48 738, and HD 96127 once might have had more planets in orbit, but that these planets were consumed over time. "It's interesting to note that, of these three newly-discovered stars, none has a planet at a distance closer than 0.6 astronomical units -- that is, 0.6 the distance of the Earth to our Sun," Wolszczan said. "It might be that 0.6 is the magic number at which any closer distance spells a planet's demise."

Observations of dying stars, their metal content, and how they affect the planets around them could provide clues about the fate of our own solar system. "Of course, in about five-billion years, our Sun will become a red giant and likely will swallow up the inner planets and the planets' accompanying moons. However, if we're still around in, say, one-billion to three-billion years, we might consider taking up residence on Jupiter's moon, Europa, for the remaining couple billion years before that happens," Wolszczan said. "Europa is an icy wasteland and it is certainly not habitable now, but as the Sun continues to heat up and expand, our Earth will become too hot, while at the same time, Europa will melt and may spend a couple billion years in the Goldilocks zone -- not to hot, not to- old, covered by vast, beautiful oceans."

Penn State's Center for Exoplanets and Habitable Worlds is organizing a conference in January 2012 to discuss planets and their dying stars. The conference will be held in Puerto Rico and is scheduled to take place at exactly 20 years from when Wolszczan used the 1,000-foot Arecibo radiotelescope to detect three planets orbiting a rapidly spinning neutron star -- the very first discovery of planets outside our solar system. This discovery opened the door to the current intense era of planet hunting by suggesting that planet formation could be quite common throughout the universe and that planets can form around different types of stellar objects. More information about the conference is online.

In addition to Wolszczan and Gettel at Penn State, other members of the research team include Andrzej Niedzielski and Gracjan Maciejewski; and three graduate students, Grzegorz Nowak, Monika Adamów, and Paweł Zieliński, who are all from Nicolaus Copernicus University in Toruń, Poland.

Funding for this research was provided by NASA and the Polish Ministry of Science and Higher Education.

Story Source:

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http://www.sciencedaily.com/releases/2011/10/111027132502.htm

Discharged from Hospital

by James Reeves; introduced by Sophie Hughes

Published: 18 October 2011

D uring his long career as a poet for children and adults, James Reeves's work received varied reviews from the TLS. In 1936 Ruth Bailey, on the basis of his first collection The Natural Need (1936), described him as a "promising" young poet with "natural ease and strength, combined with considerable technical skill". In 1952 Reeves came off worse in a comparison with a fellow writer of children's verse, Walter de la Mare: his verse was an "echo of Mr. de la Mare" but without his "ear for rhyme". That same year, Reeves was complimented and disparaged at once – alongside "Miss Ursula Wood" (who would later find fame not through her poetry, but as the patron and wife of Ralph Vaughan Williams), Reeves was described as "a minor talent" but having "pleasure to give".

Talking of his own work in 1960 Reeves explained why the historic events of his time, which commonly featured in the work of his peers, did not figure in his own poems: "To me poetry is rooted in the particular and the immediate". In "Discharged from Hospital", economy of language and the unsentimental listing of professions to describe the hospital workers creates a fast-paced yet stirring scene. Anyone who has had a prolonged stay in hospital will appreciate Reeves's lucid and droll metaphors, in particular "the rabelaisian sister with the bedpan" and "the dawn chorus of cleaners".

What Reeves may lack by way of "ear for rhyme", however, he makes up for in compassion; he has an extraordinary understanding of the complex emotions that the prognoses "cured" and "saved man" can stir up. The paradox with which the poem ends conveys the feeling of hollowness that follows a lengthy period of convalescence, of "vigorous", "sensual" and "modest" medical care. Written over twenty years after Ruth Bailey's glowing review, "Discharged from Hospital" suggests that first impressions are often the most dependable.

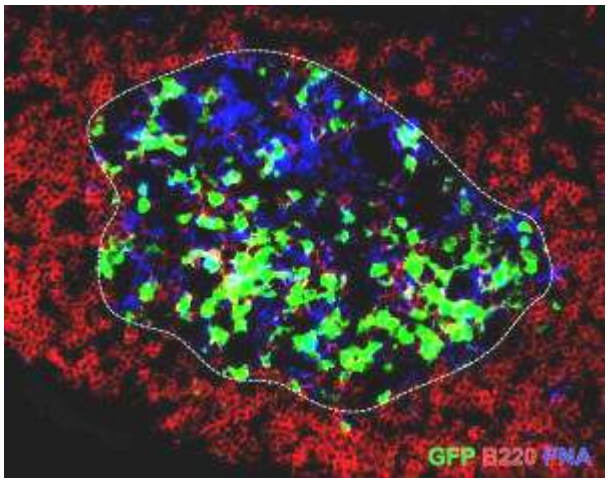
Discharged from Hospital

He stands upon the steps and fronts the morning.
The porter has called a taxi, and behind him
The infirmary doors have swung and come to rest.
Physician, surgeon, and anaesthetist
Have exercised their skill and he is cured.
The rabelaisian sister with the bedpan,
The vigorous masseuse, the sensual nurse
Who washes him modestly beneath a blanket,
The dawn chorus of cleaners, the almoner,
The visiting clergyman – all proceed without him.
He is alone beyond all need of them,
And the saved man goes home, to die of health.

JAMES REEVES (1960)

http://www.the-tls.co.uk/tls/public/article801277.ece

Natural Intestinal Flora Involved in the Emergence of Multiple Sclerosis, Study Finds



Autoaggressive B-cells (green) in a lymph node close to the brain. The activation of the B-cells takes place in the germinal centres (blue) of the lymph node. The activated cells produce antibodies against the myelin layer in the brain, thus contributing to the occurrence of inflammatory reactions. (Credit: © MPI f. Neurobiology)

ScienceDaily (Oct. 27, 2011) — Multiple sclerosis is caused by a combination of genetic and environmental factors. For a long time, pathogens were believed to be such external influences. According to scientists from the Max Planck Institute of Neurobiology in Martinsried, however, it is apparently not harmful bacteria that trigger multiple sclerosis, but beneficial ones -- specifically, the natural intestinal flora, which every human being needs for digestion. The researchers discovered that genetically modified mice develop an inflammation in the brain similar to the human disease if they have normal bacterial intestinal flora. The microorganisms begin by activating the immune system's T cells and, in a further step, the B immune cells.

The findings, published in the journal *Nature*, suggest that in humans with the corresponding genetic predisposition, the essentially beneficial intestinal flora could act as a trigger for the development of multiple sclerosis.

The human intestine is a paradise for microorganisms: it is home to roughly 100 billion bacteria made up from 2,000 different bacterial species. The microorganisms of the intestine are not only indispensable for digestion, but also for the intestine's development. Altogether, this diverse community comprises between ten and one hundred times more genes than the entire human genome. Scientists therefore frequently refer to it as the "extended self." However, the intestinal bacteria can also play a role in diseases in which the immune system attacks the body itself. Intestinal bacteria can thus promote autoimmune disorders such as Crohn's disease and rheumatoid arthritis.

On the one hand, the likelihood of developing multiple sclerosis, a disease in which proteins on the surface of the myelin layer in the brain activate the immune system, is influenced by genes. On the other, however, environmental factors have an even greater impact on the disease's development. Scientists have long suspected that it is caused by infectious agents. The Max Planck researchers now assume that multiple sclerosis is triggered by the natural intestinal flora.

This astonishing finding was made possible by newly developed genetically modified mice. In the absence of exposure to any external influences, inflammatory reactions arise in the brains of these animals which are similar to those associated with multiple sclerosis in humans -- however, this only occurs when the mice have intact intestinal flora. Mice without microorganisms in their intestines and held in a sterile environment

remained healthy. When the scientists "vaccinated" the animals raised in sterile conditions with normal intestinal microorganisms, they also became ill.

According to the Martinsried-based researchers, the intestinal flora influence immune systems in the digestive tract; mice without intestinal flora have fewer T cells there. Moreover, these animals' spleen produces fewer inflammatory substances, like cytokines. In addition, their B cells produce few or no antibodies against myelin. When the researchers restored the intestinal flora to the mice, their T cells and B cells increased their cytokine and antibody production.

"It appears that the immune system is activated in two stages: to begin, the T cells in the lymph vessels of the intestinal tract become active and proliferate. Together with the surface proteins of the myelin layer, these then stimulate the B cells to form pathogenic antibodies. Both processes trigger inflammatory reactions in the brain which progressively destroy the myelin layer -- a process that is very similar to the way multiple sclerosis develops in humans," says Gurumoorthy Krishnamoorthy from the Max Planck Institute of Neurobiology. Thus, the disease is caused by changes in the immune system and not by disturbances in the functioning of the nervous system. "Multiple sclerosis research has long been preoccupied with this question of cause and effect. Our findings would suggest that the immune system is the driving force here," says Hartmut Wekerle, Director at the Max Planck Institute in Martinsried.

The scientists are certain that the intestinal flora can also trigger an overreaction of the immune system against the myelin layer in persons with a genetic predisposition for multiple sclerosis. Therefore, nutrition may play a central role in the disease, as diet largely determines the bacteria that colonise the intestines. "Changing eating habits could explain, for example, why the incidence of multiple sclerosis has increased in Asian countries in recent years," explains Hartmut Wekerle.

Precisely which bacteria are involved in the emergence of multiple sclerosis remains unclear. Possible candidates are clostridiums, which can have direct contact with the intestinal wall. They are also a natural component of healthy intestinal flora but could possibly activate the T cells in persons with a genetic predisposition. The scientists would now like to analyse the entire microbial genome of patients with multiple sclerosis and thereby identify the differences in the intestinal flora of healthy people and multiple sclerosis patients.

Story Source:

The above story is reprinted from materials provided by **Max-Planck-Gesellschaft**.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

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1. Kerstin Berer, Marsilius Mues, Michail Koutrolos, Zakeya Al Rasbi, Marina Boziki, Caroline Johner, Hartmut Wekerle, Gurumoorthy Krishnamoorthy. **Commensal microbiota and myelin autoantigen cooperate to trigger autoimmune demyelination**. *Nature*, 2011; DOI: 10.1038/nature10554

http://www.sciencedaily.com/releases/2011/10/111027112520.htm

1994

David Benedict

We look back to a review of a production at the Young Vic of The Slab Boys Trilogy by John Byrne
Published: 27 October 2011

This article first appeared in the TLS of October 28, 1994.

John Byrne himself has designed this revival of his Slab Boys Trilogy. Given the playwright's hands-on experience of working in the "slab room" and design offices of Stoddarts carpet factory in Paisley – the setting of the first play, The Slab Boys (first performed in 1978), and the omnipresent background of all three – it is a singularly appropriate appointment.

George "Spanky" Farrell has little to look forward to as he sets about grinding colours on the marble slabs at the start of yet another day. Having mixed some colour from one of the tins of powder strewn about the set, he meticulously paints a wristwatch on his arm. It is 1957 and for Spanky and his mate, Phil McCann, time is merely something to be killed.

"Don't imagine I'm going to stand here and bandy words with the likes of you", says "plooky chops" (pimple-face) Jack Hogg (Vincent Friell), a designer, to the apprentices, exiting with all the dignity an acne-ridden yes-man in a zip-up cardigan can muster. Yet bandy words is exactly what the slab boys do. Like Lucky and Pozzo on helium, they rabbit away the time in a dazzling display of comic invention, their conversation ranging from quick-fire double-acts to increasingly baroque turns of phrase. As the wasp-waisted Lucille Bentley (a fire-spitting performance by Katy Murphy) observes: "Honest to God, see when you come in here it's like trying to find your way through the middle of Gene Vincent's wardrobe with a glow-worm on the end of a stick."

Beyond the confines of the Paisley slab room lies the land of Hollywood movies and rock and roll, whose images permeate the language and dreams of Phil and Spanky. For Phil (Paul Higgins), late for work on account of his demented mother's behaviour, escape is the driving force. For him (as it did for Byrne), escape beckons in the form of the Glasgow School of Art.

As the plot spirals into farce, the production seizes the opportunity, but its successful wooing of the audience is at the expense of weedy Hector (Paul Hickey), the butt of Phil's savage humour. Tim Supple, the director, shrinks from revealing the true viciousness of McCann's bullying, allowing it to seem merely comic. Instead, he relies on the revelation of Hector's suicide in the time-slip between the second and third plays to speak for itself, but by then it is too late. This diminishes the dramatic tension surrounding the character. Beneath the knockabout humour, we should be aware of Hector's bitterness.

The immediate concern of everyone is the "staffie", the annual staff dance taking place that evening, which becomes the occasion for the second play, Cuttin' A Rug (1979). Set initially in the Ladies' and Gents' cloakrooms of Paisley Town Hall, it develops the theme of hope adumbrated in the first play. Balancing emotions as the men and women play out the social ritual with deftly intercut dialogue, Byrne commands the structure of both individual scenes and that of the party as a whole. But the writing begins to feel tricksy despite the abundant laughs. The jockeying for position and the juggling of hope and cynicism end with Spanky looking out over the town, and wiping away the mistakes of a night with the words, "I'm nineteen with a wardrobe full of clothes . . . I've got everything to live for".

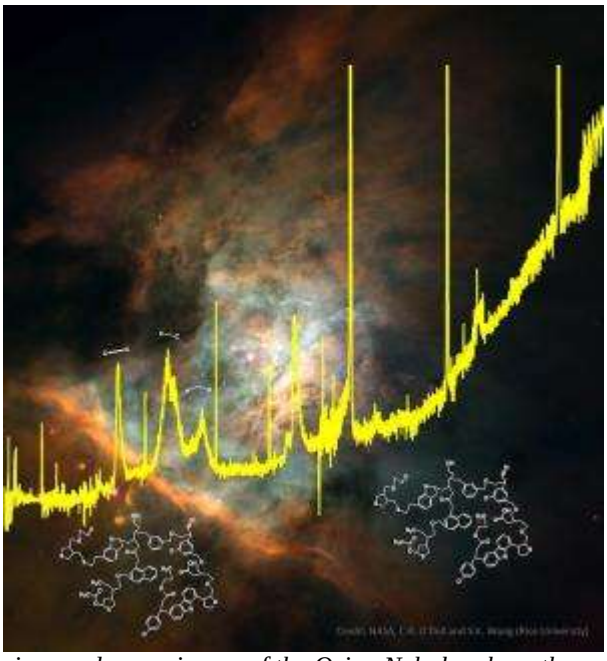
Ten years on, the present has failed to match up to their adolescent dreams. Still Life (1982) is the weakest of the three plays. The others work via the slow accretion of detail – the story of lives lovingly grounded in an all too plausible world – but regardless of the exposition, here we have to take too much on trust. The excellent Stuart McQuarrie as Spanky has little time to convince as a Beatles wannabe, before returning in Act Two, five years later, as a hippy rock star.

Part of the pleasure of seeing all of these three plays at once is witnessing these characters' stories spun out over fifteen years, but by the end, the wheels of soap-opera convention are turning uneasily in the background. Phil's final capitulation to fatherhood feels contrived, at odds with his overwhelming sense of failure and bitterness. Lucille's role degenerates into a neat tying-up of plot strands that need further exploration.

Nevertheless, The Slab Boys Trilogy is an exhilarating example of true ensemble work. Driven forward by the sheer energy of its dialogue, it is much more than a standard slice-of-life play. Here it is performed with considerable power.

http://www.the-tls.co.uk/tls/public/article807512.ece

Astronomers Discover Complex Organic Matter Exists Throughout the Universe



A spectrum from the Infrared Space Observatory superimposed on an image of the Orion Nebula where these complex organics are found. (Credit: Image courtesy of The University of Hong Kong / Background: Hubble image courtesy of NASA, C.R. O'Dell and S.K. Wong (Rice University))

ScienceDaily (Oct. 26, 2011) — Astronomers report in the journal *Nature* that organic compounds of unexpected complexity exist throughout the Universe. The results suggest that complex organic compounds are not the sole domain of life but can be made naturally by stars.

Prof. Sun Kwok and Dr. Yong Zhang of The University of Hong Kong show that an organic substance commonly found throughout the Universe contains a mixture of aromatic (ring-like) and aliphatic (chain-like) components. The compounds are so complex that their chemical structures resemble those of coal and petroleum. Since coal and oil are remnants of ancient life, this type of organic matter was thought to arise only from living organisms. The team's discovery suggests that complex organic compounds can be synthesized in space even when no life forms are present.

The researchers investigated an unsolved phenomenon: a set of infrared emissions detected in stars, interstellar space, and galaxies. These spectral signatures are known as "Unidentified Infrared Emission features." For over two decades, the most commonly accepted theory on the origin of these signatures has been that they come from simple organic molecules made of carbon and hydrogen atoms, called polycyclic aromatic hydrocarbon (PAH) molecules. From observations taken by the Infrared Space Observatory and the Spitzer Space Telescope, Kwok and Zhang showed that the astronomical spectra have features that cannot be explained by PAH molecules. Instead, the team proposes that the substances generating these infrared emissions have chemical structures that are much more complex. By analyzing spectra of star dust formed in exploding stars called novae, they show that stars are making these complex organic compounds on extremely short time scales of weeks.

Not only are stars producing this complex organic matter, they are also ejecting it into the general interstellar space, the region between stars. The work supports an earlier idea proposed by Kwok that old stars are molecular factories capable of manufacturing organic compounds. "Our work has shown that stars have no

problem making complex organic compounds under near-vacuum conditions," says Kwok. "Theoretically, this is impossible, but observationally we can see it happening."

Most interestingly, this organic star dust is similar in structure to complex organic compounds found in meteorites. Since meteorites are remnants of the early Solar System, the findings raise the possibility that stars enriched the early Solar System with organic compounds. The early Earth was subjected to severe bombardments by comets and asteroids, which potentially could have carried organic star dust. Whether these delivered organic compounds played any role in the development of life on Earth remains an open question.

Prof. Sun Kwok is the Dean of Science and Chair Professor of Physics of the University of Hong Kong. He serves as Vice President of Division VI (interstellar matter) of the International Astronomical Union, and is the incoming Vice President of Commission 51 (bioastronomy) of the International Astronomical Union. He has published many books, including the recent book "Organic Matter in the Universe" (Wiley, 2011). Dr. Yong Zhang is a Research Assistant Professor at the University of Hong Kong. This work was supported by the Research Grants Council of Hong Kong.

Story Source:

The above story is reprinted from materials provided by **The University of Hong Kong**.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

Journal Reference:

1. Sun Kwok, Yong Zhang. **Mixed aromatic–aliphatic organic nanoparticles as carriers of unidentified infrared emission features**. *Nature*, 2011; DOI: 10.1038/nature10542

http://www.sciencedaily.com/releases/2011/10/111026143721.htm

Ancient Depiction of Childbirth Discovered at Etruscan Site in Tuscany

An archaeological excavation at Poggio Colla, the site of a 2,700-year-old Etruscan settlement in Italy's Mugello Valley, has turned up a surprising and unique find: two images of a woman giving birth to a child. (Credit: Image courtesy of Southern Methodist University)

ScienceDaily (Oct. 20, 2011) — An archaeological excavation at Poggio Colla, the site of a 2,700-year-old Etruscan settlement in Italy's Mugello Valley, has turned up a surprising and unique find: two images of a woman giving birth to a child.

Researchers from the Mugello Valley Archaeological Project, which oversees the Poggio Colla excavation site some 20 miles northeast of Florence, discovered the images on a small fragment from a ceramic vessel that is more than 2,600 years old.

The images show the head and shoulders of a baby emerging from a mother represented with her knees raised and her face shown in profile, one arm raised, and a long ponytail running down her back.

The excavation is a project of Southern Methodist University, Franklin and Marshall College in Lancaster, Penn., and the University of Pennsylvania Museum of Archaeology and Anthropology, in collaboration with The Open University in Milton Keynes, England.

The identification of the scene was made by Phil Perkins, an authority on Etruscan bucchero and professor of archaeology at The Open University.

"We were astounded to see this intimate scene; it must be the earliest representation of childbirth in Western art," said Perkins. "Etruscan women are usually represented feasting or participating in rituals, or they are goddesses. Now we have to solve the mystery of who she is and who her child is."

The Etruscans were the first settlers of Italy, long before the Roman Empire. They built the first cities, were a conduit for the introduction of Greek culture to the Romans, and were known for their art, agriculture, fine metalworking and commerce. They occupied Italy for the first millennium B.C., but were conquered by the Romans and eventually became absorbed into their empire.

Image on elite pottery has implications for Poggio Colla sanctuary worship

"The birth scene is extraordinary, but what is also fascinating is what this image might mean on elite pottery at a sanctuary," said Greg Warden, professor and associate dean for academic affairs at the Meadows School of the Arts at SMU and a director of the Mugello Valley Archaeological Project.

"Might it have some connection to the cult," Warden said, "to the kind of worship that went on at the hilltop sanctuary of Poggio Colla?"

The fragment was excavated by William Nutt, who is a graduate student in anthropology at the University of Texas at Arlington and who is legally blind. Nutt was participating in the Poggio Colla Field School, which has operated for six weeks every summer since 1995.

Under the supervision of faculty from U.S. institutions and graduate students in classical archaeology and anthropology, the field school has trained approximately 20 students each year, from more than 70 American and European universities, in the theory and practice of archaeological research. Through excavation and scholarship, these students have played an integral role in understanding the Etruscan occupation of the Mugello Valley.

"I was very grateful to be accepted to the summer program at Poggio Colla -- it was my first archaeological dig," said Nutt, who is attending UTA under a National Science Foundation fellowship.

"I found the artifact at the beginning of my second week there. It was quite dirty, and we weren't sure what it was until it was cleaned at the onsite lab and identified by Perkins," Nutt said. "It was thrilling to find out that it was so significant. To make a discovery like that, which provides important new information about a culture we know so little about, is exactly what makes archaeology and anthropology so appealing."

First image of its type from Etruscan sites

The ceramic fragment is less than 1-3/4 x 1-1/4 inches (4 x 3 cm), from a vessel made of bucchero. Bucchero is a fine, black ceramic material, embellished with stamped and incised decorations, used to make eating and drinking vessels for Etruscan elites.

Typically, stamped designs range from abstract geometric motifs to exotic and mythical animals. There are no known Greek or Roman representations of the moment of birth shown as clearly as the Poggio Colla example until more than 500 years later. The fragment dates to about 600 B.C.E. (Before the Common Era).

Because the site at Poggio Colla has produced numerous votive deposits, scholars are certain that for some part of its history it was a sacred spot to a divinity or divinities.

The abundance of weaving tools and a stunning deposit of gold jewelry discovered earlier have already suggested to some scholars that the patron divinity may have been female; the discovery of the childbirth scene, because of its uniqueness, adds another piece of evidence to the theory.

"This is a most exciting discovery," said Larissa Bonfante, professor emerita of classics at New York University and an expert on the ancient Etruscans. "It shows an image of a type so far unknown in Etruscan context and gives us plenty to think about as we try to understand its religious significance."

A paper about the find will be presented at the annual meeting of the Archaeological Institute of America in Philadelphia in January. The paper, titled "Defining Northern Etruria: Evidence from Poggio Colla (Vicchio di Mugello)," will be presented by Ann Steiner, provost, dean of the faculty and Shirley Watkins Steinman Professor of Classics at Franklin and Marshall College.

Poggio Colla: Highly significant as it spans Etruscan history

Poggio Colla is a highly significant and rare site. One reason is that it spans most of Etruscan history. Archaeological evidence suggests that the site was occupied from around 700 B.C.E. until 187 B.C.E., when it was destroyed by the Romans. Another reason is that it was not buried under later construction. The Etruscans picked beautiful, easily defended hilltops for their settlements. As a result, generation after generation built new cities on top of their sites. That means many have 2000 years of other civilizations on top of Etruscan settlements and cemeteries. Poggio Colla, however, remained in its original condition. Third, Poggio Colla represents an entire settlement, including tombs, a temple, a pottery factory and an artisan community. Excavations of workshops and living quarters are yielding new details about Etruscan life to scholars.

The site centers on the acropolis, a roughly rectangular plateau of one and a half acres at the summit of Poggio Colla. Excavations have found strong evidence that the acropolis was home to a sanctuary and have identified a temple building and an altar at the center of a large courtyard. Numerous offerings have been found buried around the altar, gifts left behind as part of a sacred ritual to a still unidentified deity. These votive donations range from a massive deposit of nearly 500 varied bronze objects, to a spectacular gift of women's gold jewelry and semi-precious stones. Another votive deposit contains a collection of ritual objects that were laid to rest in a room at the northwest corner of the sanctuary courtyard, possibly by a priest.

Unique religious context allowed first reconstruction of actual rituals

Excavators discovered a large circular pit, at the center of which was placed a sandstone cylinder, possibly the top of a votive column. Carefully situated near the cylinder were two sandstone statue bases, the larger of which includes the inscribed name of the aristocratic donor. Buried alongside these objects were a strand of gold wire, a purposely broken bronze implement, and two bronze bowls that had been used to pour ritual libations, as well as the bones of a piglet, presumably sacrificed as part of a purification ritual. This unique religious context has allowed researchers to reconstruct, for the first time, the actual rituals and actions of the priest/magistrate who presided over the ceremonies.

Although the Etruscan site now called Poggio Colla has been known since the 19th century, it was first excavated from 1968 to 1972 by Francesco Nicosia, the former Superintendent of Archaeology in Tuscany. With Nicosia's permission and encouragement, SMU professor Greg Warden, a Mugello Valley native, reopened the site in 1995, established the Mugello Valley Archaeological Project and launched the summer Poggio Colla Field School. Today the project continues to proceed with the permission and supervision of the Soprintendenza per i Beni Archeologici per la Toscana and Luca Fedeli, Inspector.

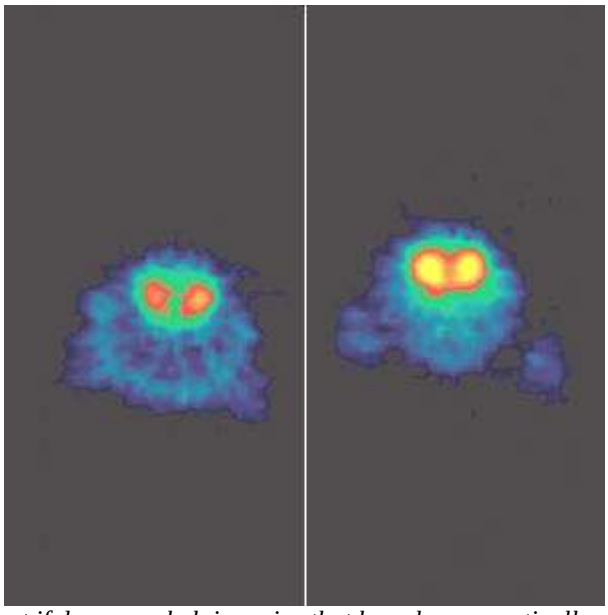
Directors of the project include Warden; Steiner; Michael L. Thomas, senior research associate at the University of Texas at Austin; and Gretchen Meyers, assistant professor of classics at Franklin & Marshall College. They oversee a team of archaeologists, scientists, architects and conservators who are conducting a systematic and multi-disciplined study of Poggio Colla, including stratigraphic excavation, scientific analysis, geophysical mapping and land surveys.

Story Source:

The above story is reprinted from materials provided by **Southern Methodist University**.

http://www.sciencedaily.com/releases/2011/10/111020025756.htm

Brain Scans Reveal Drugs' Effects On Attention



Scientists have developed a way to use PET scans to test if drugs are helping mice that have been genetically engineered to have a form of attention deficit. In the brain of the altered mouse (right), low dopamine levels result in a brighter image. (Credit: David Gutmann, MD, PhD)

ScienceDaily (Oct. 14, 2011) — Scientists have developed a way to evaluate new treatments for some forms of attention deficit disorder.

Working in mice, researchers at Washington University School of Medicine in St. Louis showed that they can use brain scans to quickly test whether drugs increase levels of a brain chemical known as dopamine.

In a study published last year, the same group found that raising dopamine levels in mice alleviates attention deficits caused by neurofibromatosis type 1 (NF1), a condition that affects more than 100,000 people in the United States. Approximately 60 percent to 80 percent of children with NF1 have some type of attention deficit problem.

"Many kids with NF1 really struggle in school, and finding ways to help alleviate attention problems is a high priority," says David H. Gutmann, MD, PhD, the Donald O. Schnuck Family Professor of Neurology. "The technique we've refined may make it possible to match specific treatments to the patients with NF1 and attention deficit who are most likely to benefit from those treatments."

The results appear online in *Experimental Neurology*.

Symptoms of NF1-related attention deficits are similar to those that affect children in the general population. But it's unclear whether the brain changes that underlie these problems in children with NF1 are similar to the brain changes that cause attention deficits in the general population.

"This mouse model may not be a perfect model for all forms of attention deficit, but it is a terrific model for one type of attention system dysfunction," Gutmann says. "Greater understanding of what goes wrong in some children with NF1 could lead to new insights into a broader variety of attention problems."

Gutmann is director of the Washington University Neurofibromatosis (NF) Center, a national referral center for patients with all forms of neurofibromatosis. The center is active in basic science research and clinical trials, with the goal of developing innovative new approaches for treating patients with NF.

Gutmann and his colleagues have developed genetically engineered mice that develop NF1-related attention problems and brain tumors.

Last year, Gutmann showed that one of these lines of mice had lower levels of dopamine in part of the brain. Following treatment with the drug Ritalin, both the brain dopamine levels and the attention deficits in these mice were restored to normal.

"Prior to our study, there was no molecular basis for using Ritalin to treat children with NF1 and attention deficits, so its use depended on the pediatrician's practice, the severity of the attention deficit and how comfortable the parents were with the use of medication," Gutmann says. "In general, only the most severely affected kids are being treated, but that may change in the future."

For the new study, Gutmann collaborated with Robert Mach, PhD, professor of radiology, who had been working with an imaging agent, raclopride, that binds to dopamine receptors in the brain. Raclopride can be detected by positron emission tomography (PET) scans.

When Jinbin Xu, PhD, research instructor in radiology, used raclopride to test dopamine levels in untreated mice, lower levels of brain dopamine allowed for greater raclopride binding, creating a brighter PET image. Following Ritalin treatment, the raclopride binding decreased.

"This finding suggested that raclopride PET imaging could be used as a platform for preclinical testing of drugs that may affect brain dopamine levels," Gutmann says. "We can get an image in an hour and assess the effects of the drug on mouse behavior in a day."

Washington University scientists including David Wozniak, PhD, and Kelly Diggs-Andrews, PhD, and former Washington University researcher Jackie Brown, PhD**,** used the new method to test additional drugs. A compound designed to block the recycling of dopamine was successful in restoring dopamine levels. In contrast, another drug, currently in a clinical trial for learning problems in children with NF1, did not boost dopamine levels or correct the attention deficits.

Conducting similar tests in children using current PET technology involves significant radiation exposure, Gutmann says. However, a new scanner now available at Washington University that combines PET and MRI will lower the radiation exposure, making it possible to consider this method for children with NF1.

"At some point, we envision a prescreening process that identifies children with reduced dopamine levels most likely to respond to Ritalin or other medications," Gutmann says. "As we learn more about the different ways attention deficits arise in these children, it may be possible to use the prescreening data and preclinical drug tests in mouse models to select the best drug for each patient."

Funding from the U.S. Department of Defense supported this research.

Story Source:

The above story is reprinted from materials provided by **Washington University School of Medicine**. The original article was written by Michael C. Purdy.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

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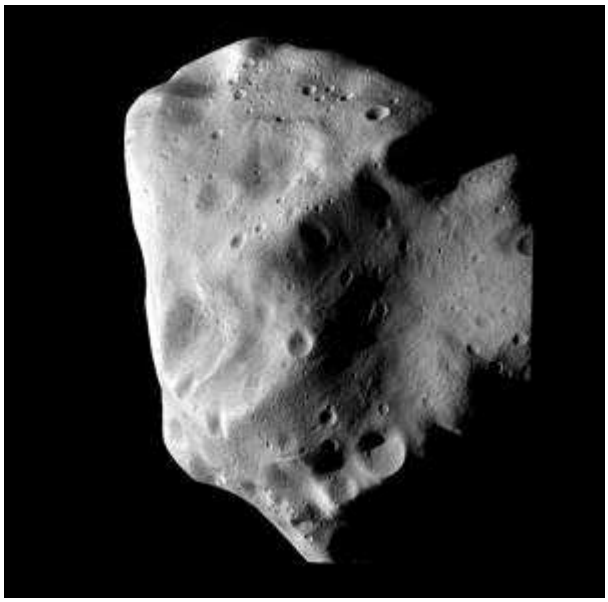
http://www.sciencedaily.com/releases/2011/10/111014104944.htm

Asteroid Lutetia: Primitive Body from Solar System's Planet-Forming Period



A year after the flyby, the analysis shows that Lutetia is a primordial asteroid, with a surface covered in craters, pulverised rocks and landslides. It may also have tried to form an iron-core billions of years ago. (Credit: ESA 2010 MPS for OSIRIS Team MPS/UPD/LAM/IAA/RSSD/INTA/UPM/DASP/IDA)

ScienceDaily (Oct. 28, 2011) — The European Space Agency's Rosetta spacecraft has revealed asteroid Lutetia to be a primitive body, left over as the planets were forming in our Solar System. Results from Rosetta's fleeting flyby also suggest that this mini-world tried to grow a metal heart.

Rosetta flew past Lutetia on 10 July 2010 at a speed of 54 000 km/hr and a closest distance of 3170 km. At the time, the 130 km-long asteroid was the largest encountered by a spacecraft. Since then, scientists have been analysing the data taken during the brief encounter.

All previous flybys went past objects, which were fragments of once-larger bodies. However, during the encounter, scientists speculated that Lutetia might be an older, primitive 'mini-world'.

Now they are much more certain. Images from the OSIRIS camera reveal that parts of Lutetia's surface are around 3.6 billion years old. Other parts are young by astronomical standards, at 50-80 million years old.

Astronomers estimate the age of airless planets, moons, and asteroids by counting craters. Each bowl-shaped depression on the surface is made by an impact. The older the surface, the more impacts it will have accumulated. Some parts of Lutetia are heavily cratered, implying that it is very old.

On the other hand, the youngest areas of Lutetia are landslides, probably triggered by the vibrations from particularly jarring nearby impacts.

Debris resulting from these many impacts now lies across the surface as a 1 km-thick layer of pulverised rock.

There are also boulders strewn across the surface: some are 300-400 m across, or about half the size of Ayers Rock, in Australia.

Some impacts must have been so large that they broke off whole chunks of Lutetia, gradually sculpting it into the battered wreck we see today.

"We don't think Lutetia was born looking like this," says Holger Sierks, Max-Planck-Institut für Sonnensystemforschung, Lindau, Germany. "It was probably round when it formed."

Rosetta's VIRTIS spectrometer found that Lutetia's composition is remarkably uniform across all the observed regions.

"It is striking that an object of this size can bear scars of events so different in age across its surface while not showing any sign of surface compositional variation," says Fabrizio Capaccioni, INAF, Rome, Italy.

This is just the start of the mystery.

Rosetta also let scientists investigate beneath the asteroid's surface. It appears that Lutetia tried to grow an iron core like a bona-fide planet when it formed.

During the encounter, Lutetia's weak gravity tugged on Rosetta. The slight change in Rosetta's path was reflected in radio signals received back at Earth, indicating a mass of 1.7 million billion tonnes.

This was a surprise.

"The mass was lower than expected. Ground-based observations had suggested much higher values," says Martin Pätzold, Universität zu Köln, Germany, leader of the radio science team.

Nevertheless, when combined with its volume, Lutetia still turns out to have one of the highest densities of any known asteroid: 3400 kg per cubic metre. The density implies that Lutetia contains significant quantities of iron, but not necessarily in a fully formed core.

To form an iron core, Lutetia would have had to melt as a result of heat released by radioactive isotopes in its rocks. The dense iron would then sink to the centre and the rocky material would float to the top.

However, VIRTIS indicates that Lutetia's surface composition remains entirely primordial, displaying none of the rocky material expected to form during such a molten phase.

The only explanation appears to be that Lutetia was subjected to some internal heating early in its history but did not melt completely and so did not end up with a well-defined iron core.

These results, all gathered during just a short flyby, make Lutetia a unique asteroid and an invaluable postcard from the past, at a time when Earth was forming.

"We picked a most important member of the asteroid belt," said Rita Schulz, ESA's Rosetta Project Scientist.

"All the asteroids encountered so far were different from each other, but Lutetia is the only one in which both primordial and differentiation features have been found.

"These unexpected results clearly show that there is still much more to investigate before we understand the belt fully."

Having now left Lutetia far behind, Rosetta is in hibernation and en route to its 2014 rendezvous with comet Churyumov-Gerasimenko.

Story Source:

The above story is reprinted from materials provided by **European Space Agency (ESA)**.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

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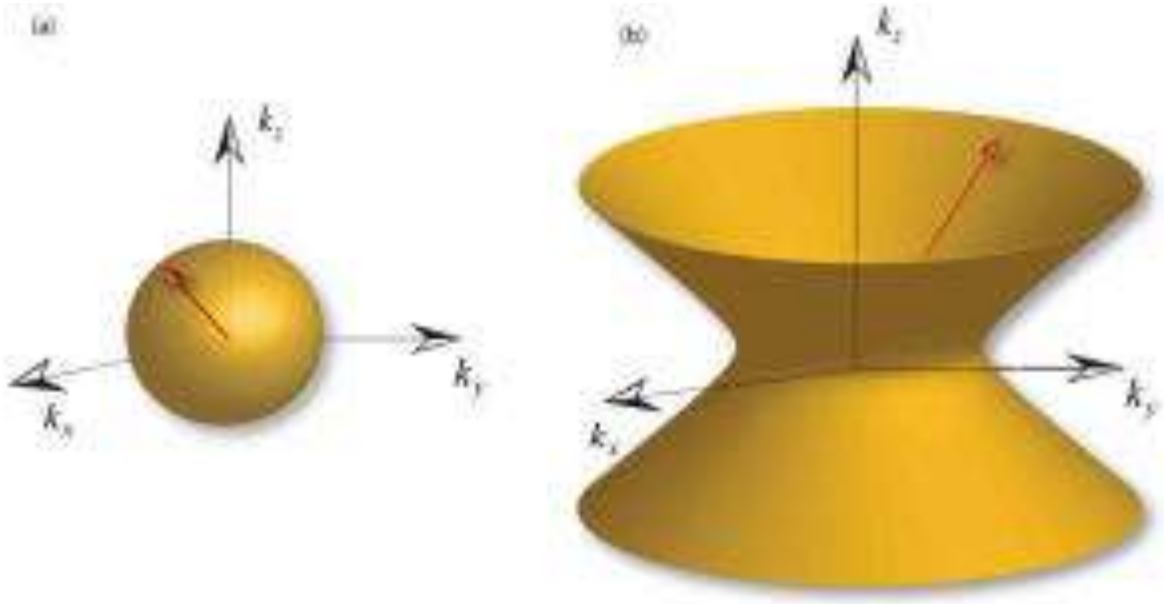
http://www.sciencedaily.com/releases/2011/10/111028144010.htm

New Hybrid Technology Could Bring 'Quantum Information Systems'



Structures called "metamaterials" and the merging of two technologies under development are promising the emergence of new "quantum information systems" far more powerful than today's computers. The concept hinges on using single photons – the tiny particles that make up light – for switching and routing in future computers that might harness the exotic principles of quantum mechanics. The image at left depicts a "spherical dispersion" of light in a conventional material, and the image at right shows the design of a metamaterial that has a "hyperbolic dispersion" not found in any conventional material, potentially producing quantum-optical applications. (Credit: Zubin Jacob)

ScienceDaily (Oct. 28, 2011) — The merging of two technologies under development -- plasmonics and nanophotonics -- is promising the emergence of new "quantum information systems" far more powerful than today's computers.

The technology hinges on using single photons -- the tiny particles that make up light -- for switching and routing in future computers that might harness the exotic principles of quantum mechanics.

The quantum information processing technology would use structures called "metamaterials," artificial nanostructured media with exotic properties.

The metamaterials, when combined with tiny "optical emitters," could make possible a new hybrid technology that uses "quantum light" in future computers, said Vladimir Shalaev, scientific director of nanophotonics at Purdue University's Birck Nanotechnology Center and a distinguished professor of electrical and computer engineering.

The concept is described in an article published on October 28 in the journal *Science*. The article appeared in the magazine's Perspectives section and was written by Shalaev and Zubin Jacob, an assistant professor of electrical and computer engineering at the University of Alberta, Canada.

"A seamless interface between plasmonics and nanophotonics could guarantee the use of light to overcome limitations in the operational speed of conventional integrated circuits," Shalaev said.

Researchers are proposing the use of "plasmon-mediated interactions," or devices that manipulate individual photons and quasiparticles called plasmons that combine electrons and photons.

One of the approaches, pioneered at Harvard University, is a tiny nanowire that couples individual photons and plasmons. Another approach is to use hyperbolic metamaterials, suggested by Jacob; Igor Smolyaninov, a visiting research scientist at the University of Maryland; and Evgenii Narimanov, an associate professor of electrical and computer engineering at Purdue. Quantum-device applications using building blocks for such hyperbolic metamaterials have been demonstrated in Shalaev's group.

"We would like to record and read information with single photons, but we need a very efficient source of single photons," Shalaev said. "The challenge here is to increase the efficiency of generation of single photons in a broad spectrum, and that is where plasmonics and metamaterials come in."

Today's computers work by representing information as a series of ones and zeros, or binary digits called "bits."

Computers based on quantum physics would have quantum bits, or "qubits," that exist in both the on and off states simultaneously, dramatically increasing the computer's power and memory. Quantum computers would take advantage of a strange phenomenon described by quantum theory called "entanglement." Instead of only the states of one and zero, there are many possible "entangled quantum states" in between one and zero.

An obstacle in developing quantum information systems is finding a way to preserve the quantum information long enough to read and record it. One possible solution might be to use diamond with "nitrogen vacancies," defects that often occur naturally in the crystal lattice of diamonds but can also be produced by exposure to high-energy particles and heat.

"The nitrogen vacancy in diamond operates in a very broad spectral range and at room temperature, which is very important," Shalaev said.

The work is part of a new research field, called diamond photonics. Hyperbolic metamaterials integrated with nitrogen vacancies in diamond are expected to work as efficient "guns" of single photons generated in a broad spectral range, which could bring quantum information systems, he said.

Story Source:

The above story is reprinted from materials provided by **Purdue University**. The original article was written by Emil Venere.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

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Obese People Regain Weight After Dieting Due to Hormones

Although restriction of diet often results in initial weight loss, more than 80 per cent of obese dieters fail to maintain their reduced weight. (Credit: © Luis Louro / Fotolia)

ScienceDaily (Oct. 28, 2011) — Worldwide, there are more than 1.5 billion overweight adults, including 400 million who are obese. In Australia, it is estimated more than 50 per cent of women and 60 per cent of men are either overweight or obese.

Although restriction of diet often results in initial weight loss, more than 80 per cent of obese dieters fail to maintain their reduced weight. Obese people may regain weight after dieting due to hormonal changes, a new study has shown.

The study involved 50 overweight or obese adults, with a BMI of between 27 and 40, and an average weight of 95kg, who enrolled in a 10-week weight loss program using a very low energy diet. Levels of appetite-regulating hormones were measured at baseline, at the end of the program and one year after initial weight loss.

Results showed that following initial weight loss of about 13 kgs, the levels of hormones that influence hunger changed in a way which would be expected to increase appetite. These changes were sustained for at least one year. Participants regained around 5kgs during the one-year period of study.

Professor Joseph Proietto from the University of Melbourne and Austin Health said the study revealed the important roles that hormones play in regulating body weight, making dietary and behavioral change less likely to work in the long-term.

"Our study has provided clues as to why obese people who have lost weight often relapse. The relapse has a strong physiological basis and is not simply the result of the voluntary resumption of old habits," he said.

Dr Proietto said although health promotion campaigns recommended obese people adopt lifestyle changes such as to be more active, they were unlikely to lead to reversal of the obesity epidemic.

"Ultimately it would be more effective to focus public health efforts in preventing children from becoming obese."

"The study also suggests that hunger following weight loss needs to be addressed. This may be possible with long-term pharmacotherapy or hormone manipulation but these options need to be investigated," he said.

The study was done in collaboration with La Trobe University. It was published in the *New England Journal of Medicine.*

Story Source:

The above story is reprinted from materials provided by **University of Melbourne**.

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Highly Efficient Oxygen Catalyst Found: Rechargeable Batteries and Hydrogen-Fuel Production Could Benefit

Materials Science and Engineering Graduate Student Jin Suntivich (left) and Mechanical Engineering Graduate Student Kevin J. May (right) inspecting the electrochemical cell for oxygen evolution reaction experiment. (Credit: Photo by Jonathon R. Harding)

ScienceDaily (Oct. 28, 2011) — A team of researchers at MIT has found one of the most effective catalysts ever discovered for splitting oxygen atoms from water molecules -- a key reaction for advanced energy-storage systems, including electrolyzers, to produce hydrogen fuel and rechargeable batteries. This new catalyst liberates oxygen at more than 10 times the rate of the best previously known catalyst of its type.

The new compound, composed of cobalt, iron and oxygen with other metals, splits oxygen from water (called the Oxygen Evolution Reaction, or OER) at a rate at least an order of magnitude higher than the compound currently considered the gold standard for such reactions, the team says. The compound's high level of activity was predicted from a systematic experimental study that looked at the catalytic activity of 10 known compounds.

The team, which includes materials science and engineering graduate student Jin Suntivich, mechanical engineering graduate student Kevin J. May and professor Yang Shao-Horn, published their results in *Science* on Oct. 28.

The scientists found that reactivity depended on a specific characteristic: the configuration of the outermost electron of transition metal ions. They were able to use this information to predict the high reactivity of the new compound -- which they then confirmed in lab tests.

"We not only identified a fundamental principle" that governs the OER activity of different compounds, "but also we actually found this new compound" based on that principle, says Shao-Horn, the Gail E. Kendall (1978) Associate Professor of Mechanical Engineering and Materials Science and Engineering.

Many other groups have been searching for more efficient catalysts to speed the splitting of water into hydrogen and oxygen. This reaction is key to the production of hydrogen as a fuel to be used in cars; the operation of some rechargeable batteries, including zinc-air batteries; and to generate electricity in devices called fuel cells. Two catalysts are needed for such a reaction -- one that liberates the hydrogen atoms, and another for the oxygen atoms -- but the oxygen reaction has been the limiting factor in such systems.

Other groups, including one led by MIT's Daniel Nocera, have focused on similar catalysts that can operate -- in a so-called "artificial leaf" -- at low cost in ordinary water. But such reactions can occur with higher efficiency in alkaline solutions, which are required for the best previously known catalyst, iridium oxide, as well as for this new compound.

Shao-Horn and her collaborators are now working with Nocera, integrating their catalyst with his artificial leaf to produce a self-contained system to generate hydrogen and oxygen when placed in an alkaline solution. They will also be exploring different configurations of the catalyst material to better understand the mechanisms involved. Their initial tests used a powder form of the catalyst; now they plan to try thin films to better understand the reactions.

In addition, even though they have already found the highest rate of activity yet seen, they plan to continue searching for even more efficient catalyst materials. "It's our belief that there may be others with even higher activity," Shao-Horn says.

Jens Norskov, a professor of chemical engineering at Stanford University and director of the Suncat Center for Interface Science and Catalysis there, who was not involved in this work, says, "I find this an extremely interesting 'rational design' approach to finding new catalysts for a very important and demanding problem."

The research, which was done in collaboration with visiting professor Hubert A. Gasteiger (currently a professor at the Technische Universität München in Germany) and professor John B. Goodenough from the University of Texas at Austin, was supported by the U.S. Department of Energy's Hydrogen Initiative, the National Science Foundation, the Toyota Motor Corporation and the Chesonis Foundation.

Story Source:

The above story is reprinted from materials provided by **Massachusetts Institute of Technology**. The original article was written by David L. Chandler, MIT News Office.

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Planets Smashed Into Dust Near Supermassive Black Holes

2006 Hubble Space Telescope image of the "light echo" of dust illuminated by the nearby star V838 Monocerotis that became 600,000 times more luminous than our Sun in January 2002. The flash is believed to have been caused by a giant collision of some kind, e.g., between two stars or a star and a planet. (Credit: NASA, ESA, and H. Bond (STScI))

ScienceDaily (Oct. 28, 2011) — Fat doughnut-shaped dust shrouds that obscure about half of supermassive black holes could be the result of high speed crashes between planets and asteroids, according to a new theory from an international team of astronomers.

The scientists, led by Dr. Sergei Nayakshin of the University of Leicester, are publishing their results in the journal *Monthly Notices of the Royal Astronomical Society*.

Supermassive black holes reside in the central parts of most galaxies. Observations indicate that about 50% of them are hidden from view by mysterious clouds of dust, the origin of which is not completely understood. The new theory is inspired by our own Solar System, where the so-called zodiacal dust is known to originate from collisions between solid bodies such as asteroids and comets. The scientists propose that the central regions of galaxies contain not only black holes and stars but also planets and asteroids.

Collisions between these rocky objects would occur at colossal speeds as large as 1000 km per second, continuously shattering and fragmenting the objects, until eventually they end up as microscopic dust. Dr. Nayakshin points out that this harsh environment -- radiation and frequent collisions -- would make the planets orbiting supermassive black holes sterile, even before they are destroyed. "Too bad for life on these planets," he says, "but on the other hand the dust created in this way blocks much of the harmful radiation from reaching the rest of the host galaxy. This in turn may make it easier for life to prosper elsewhere in the rest of the central region of the galaxy."

He also believes that understanding the origin of the dust near black holes is important in our models of how these monsters grow and how exactly they affect their host galaxies. "We suspect that the supermassive black hole in our own Galaxy, the Milky Way, expelled most of the gas that would otherwise turn into more stars and planets," he continues, "Understanding the origin of the dust in the inner regions of galaxies would take us one step closer to solving the mystery of the supermassive black holes."

Story Source:

The above story is reprinted from materials provided by **Royal Astronomical Society (RAS)**.

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Antarctic Killer Whales May Seek Spa-Like Relief in the Tropics

Pod of killer whales. (Credit: © pr2is / Fotolia)

ScienceDaily (Oct. 26, 2011) — NOAA researchers offer a novel explanation for why a type of Antarctic killer whale performs a rapid migration to warmer tropical waters. Scientists believe that warmer waters help the whales regenerate skin faster, after spending months coated with algae in colder waters.

"The whales are traveling so quickly, and in such a consistent track, that it is unlikely they are foraging for food or giving birth," said John Durban, lead author from NOAA's Southwest Fisheries Science Center in La Jolla, California. "We believe these movements are likely undertaken to help the whales regenerate skin tissue in a warmer environment with less heat loss."

As evidence, the researchers point to the yellowish coating on Antarctic killer whales caused by a thick accumulation of diatoms or algae on the outer skin of the animals. The coloring is noticeably absent when they return from warmer waters indicating the upper epidermis of the skin has been shed.

One tagged Antarctic killer whale monitored by satellite traveled over 5,000 miles to visit the warm waters off southern Brazil before returning immediately to Antarctica just 42 days later. This was the first long distance migration ever reported for killer whales.

The coloring is noticeably absent when they return from warmer waters indicating the upper layer of skin has been shed. The scientists tagged 12 Type B killer whales (seal-feeding specialists) near the Antarctic Peninsula and tracked 5 that revealed consistent movement to sub-tropical waters. The whales tended to slow in the warmest waters although there was no obvious interruption in swim speed or direction to indicate calving or prolonged feeding.

"They went to the edge of the tropics at high speed, turned around and came straight back to Antarctica, at the onset of winter," said Robert Pitman, co-author of the study. "The standard feeding or breeding migration does not seem to apply here."

Researchers believe there are at least three different types of killer whales in Antarctica and have labeled them Types A, B and C.

Story Source:

The above story is reprinted from materials provided by **NOAA National Marine Fisheries Service**.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

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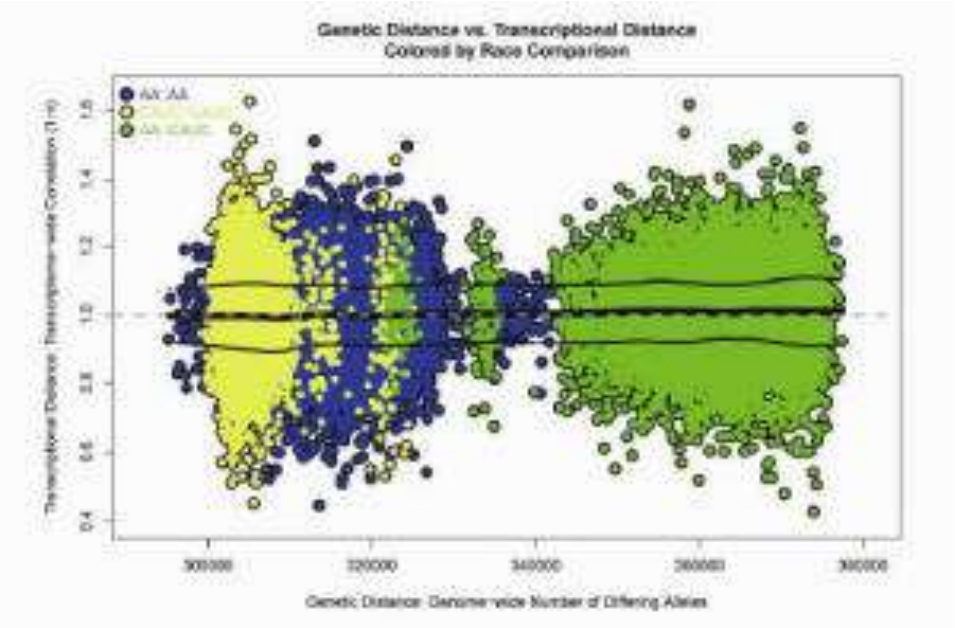
Human Brains Are Made of the Same Stuff, Despite DNA Differences



Our brains are all made of the same stuff: Despite individual and ethnic genetic diversity, our prefrontal cortex shows a consistent molecular architecture. For example, overall differences in the genetic code ("genetic distance") between African -Americans (AA) and caucasians (cauc) showed no effect on their overall difference in expressed transcripts ("transcriptional distance"). The vertical span of color-coded areas is about the same, indicating that our brains all share the same tissue at a molecular level, despite distinct DNA differences on the horizontal axis. Each dot represents a comparison between two individuals. The AA::AA comparisons (blue) generally show more genetic diversity than cauc::cauc comparisons (yellow), because caucasians are descended from a relatively small subset of ancestors who migrated from Africa, while African Americans are descended from a more diverse gene pool among the much larger population that remained in Africa. AA::cauc comparisons (green) differed most across their genomes as a whole, but this had no effect on their transcriptomes as a whole. (Credit: Joel Kleinman, M.D., Ph.D., NIMH Clinical Brain Disorders Branch)

ScienceDaily (Oct. 26, 2011) — Despite vast differences in the genetic code across individuals and ethnicities, the human brain shows a "consistent molecular architecture," say researchers supported by the National Institutes of Health. The finding is from a pair of studies that have created databases revealing when and where genes turn on and off in multiple brain regions through development.

"Our study shows how 650,000 common genetic variations that make each of us a unique person may influence the ebb and flow of 24,000 genes in the most distinctly human part of our brain as we grow and age," explained Joel Kleinman, M.D., Ph.D., of the National Institute of Mental Health (NIMH) Clinical Brain Disorders Branch.

Kleinman and NIMH grantee Nenad Sestan, M.D., Ph.D. of Yale University, New Haven, Conn., led the sister studies in the Oct. 27, 2011 issue of the journal *Nature*.

"Having at our fingertips detailed information about when and where specific gene products are expressed in the brain brings new hope for understanding how this process can go awry in schizophrenia, autism and other brain disorders," said NIMH Director Thomas R. Insel, M.D.

Both studies measured messenger RNAs or transcripts. These intermediate products carry the message from DNA, the genetic blueprint, to create proteins and differentiated brain tissue. Each gene can make several transcripts, which are expressed in patterns influenced by a subset of the approximately 1.5 million DNA variations unique to each of us. This unique set of transcripts is called our transcriptome -- a molecular signature that is unique to every individual. The transcriptome is a measure of the diverse functional potential that exists in the brain.

Both studies found that rapid gene expression during fetal development abruptly switches to much slower rates after birth that gradually decline and eventually level off in middle age. These rates surge again as the brain ages in the last decades, mirroring rates seen in childhood and adolescence, according to one of the studies. The databases hold secrets to how the brain's ever-changing messenger chemical systems, cells and development processes are related to gene expression patterns through development.

For example, if a particular version of a gene is implicated in a disorder, the new resources might reveal how that variation affects the gene's expression over time and by brain region. By identifying even distant genes that may be turning on and off in-sync, the databases may help researchers discover whole modules of genes involved in the illness. They can also reveal how variation in one gene influences another's expression.

Prefrontal cortex

Kleinman's team focused on how genetic variations are linked to the expression of transcripts in the brain's prefrontal cortex, the area that controls insight, planning and judgment, across the lifespan. They studied 269 postmortem, healthy human brains, ranging in age from two weeks after conception to 80 years old, using 49,000 genetic probes. The database on prefrontal cortex gene expression alone totals more than 1 trillion pieces of information, according to Kleinman.

Among key findings in the prefrontal cortex:

- Individual genetic variations are profoundly linked to expression patterns. The most similarity across individuals is detected early in development and again as we approach the end of life.
- Different types of related genes are expressed during prenatal development, infancy, and childhood, so that each of these stages shows a relatively distinct transcriptional identity. Three-fourths of genes reverse their direction of expression after birth, with most switching from on to off.
- Expression of genes involved in cell division declines prenatally and in infancy, while expression of genes important for making synapses, or connections between brain cells, increases. In contrast, genes required for neuronal projections decline after birth -- likely as unused connections are pruned.
- By the time we reach our 50s, overall gene expression begins to increase, mirroring the sharp reversal of fetal expression changes that occur in infancy.
- Genetic variation in the genome as a whole showed no effect on variation in the transcriptome as a whole, despite how genetically distant individuals might be. Hence, human cortexes have a consistent molecular architecture, despite our diversity.

In previous studies, Kleinman and colleagues have found that all genetic variations implicated to date in schizophrenia are associated with transcripts that are preferentially expressed in the fetal brain. This adds to evidence that the disorder originates in prenatal development. By contrast, he and his colleagues are examining evidence that genetic variation implicated in affective disorders may be associated with transcripts expressed later in life. They are also extending their database to include all transcripts of all the genes in the human genome, examining 1000 post-mortem brains, including many of people who had schizophrenia or other brain disorders.

Multiple brain regions

Sestan and colleagues characterized gene expression in 16 brain regions, including 11 areas of the neocortex, from both hemispheres of 57 human brains that spanned from 40 days post-conception to 82 years -- analyzing the transcriptomes of 1,340 samples. Using 1.4 million probes, the researchers measured the expression of exons, which combine to form a gene's protein product. This allowed them to pinpoint changes in these combinations that make up a protein, as well as to chart the gene's overall expression.

Among key findings:

- Over 90 percent of the genes expressed in the brain are differentially regulated across brain regions and/or over developmental time periods. There are also widespread differences across region and time periods in the combination of a gene's exons that are expressed.
- Timing and location are far more influential in regulating gene expression than gender, ethnicity or individual variation.
- Among 29 modules of co-expressed genes identified, each had distinct expression patterns and represented different biological processes. Genetic variation in some of the most well-connected genes in these modules, called hub genes, has previously been linked to mental disorders, including schizophrenia and depression.
- Telltale similarities in expression profiles with genes previously implicated in schizophrenia and autism are providing leads to discovery of other genes potentially involved in those disorders.
- Sex differences in the risk for certain mental disorders may be traceable to transcriptional mechanisms. More than three-fourths of 159 genes expressed differentially between the sexes were male-biased, most prenatally. Some genes found to have such sex-biased expression had previously been associated with disorders that affect males more than females, such as schizophrenia, Williams syndrome, and autism.

The Sestan study was also funded by NIH's National Institute on Child Health and Human Development, National Institute on Neurological Disorders and Stroke, and National Institute on Drug Abuse. Data for the Sestan study are posted at www.humanbraintranscriptome.org and at http://www.developinghumanbrain.org, as part of a larger ongoing study, BrainSpan, funded by NIMH under the American Recovery and Reinvestment Act to create an Atlas of Human Brain Development.

The Kleinman study data on genetic variability are accessible to qualified researchers at http://www.ncbi.nlm.nih.gov/projects/gap/cgi-bin/study.cgi?study_id5phs000417.v1.p1, while the gene expression data can be found at http://www.ncbi.nlm.nih.gov/geo/query/acc.cgi?acc5GSE30272. In addition, BrainCloud, a web browser application developed by NIMH to interrogate the Kleinman study data, can be downloaded at http://www.libd.org/braincloud.

Story Source:

The above story is reprinted from materials provided by **NIH/National Institute of Mental Health**.

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Land Animals, Ecosystems Walloped After Permian Dieoff

Survivors: Lystrosaurus, a relative to mammals, was one of a handful of "disaster taxa" to escape from the rubble of the Permian Period, along with the meter-high spore-tree Pleuromeia. Low diversity of animals delayed the full recovery of land ecosystems by millions of years. (Credit: Victor Leshyk)

ScienceDaily (Oct. 25, 2011) — The cataclysmic events that marked the end of the Permian Period some 252 million years ago were a watershed moment in the history of life on Earth. As much as 90 percent of ocean organisms were extinguished, ushering in a new order of marine species, some of which we still see today. But while land dwellers certainly sustained major losses, the extent of extinction and the reshuffling afterward were less clear.

In a paper published in the journal *Proceedings of the Royal Society B*, researchers at Brown University and the University of Utah undertook an exhaustive specimen-by-specimen analysis to confirm that land-based vertebrates suffered catastrophic losses as the Permian drew to a close. From the ashes, the survivors, a handful of genera labeled "disaster taxa," were free to roam more or less unimpeded, with few competitors in their respective ecological niches. This lack of competition, the researchers write, caused vicious boom-and-bust cycles in the ecosystems, as external forces wreaked magnified havoc on the tenuous links in the food web. As a result, the scientists conclude from the fossil record that terrestrial ecosystems took up to 8 million years to rebound fully from the mass extinction through incremental evolution and speciation.

"It means the (terrestrial ecosystems) were more subject to greater risk of collapse because there were fewer links" in the food web, said Jessica Whiteside, assistant professor of geological sciences at Brown and co-author on the paper.

The boom-and-bust cycles that marked land-based ecosystems' erratic rebound were like "mini-extinction events and recoveries," said Randall Irmis, a co-author on the paper, who is a curator of paleontology at the Natural History Museum of Utah and an assistant professor of geology and geophysics at Utah.

The hypothesis, in essence, places ecosystems' recovery post-Permian squarely on the repopulation and diversification of species, rather than on an outside event, such as a smoothing out of climate. The analysis mirrors the conclusions reached by Whiteside in a paper published last year in *Geology*, in which she and a colleague argued that it took up to 10 million years after the end-Permian mass extinction for enough species to repopulate the ocean -- restoring the food web -- for the marine ecosystem to stabilize.

"It really is the same pattern" with land-based ecosystems as marine environments, Whiteside said. The same seems to hold true for plants, she added.

Some studies have argued that continued volcanism following the end-Permian extinction kept ecosystems' recovery at bay, but Whiteside and Irmis say there's no physical evidence of such activity.

The researchers examined nearly 8,600 specimens, from near the end of the Permian to the middle Triassic, roughly 260 million to 242 million years ago. The fossils came from sites in the southern Ural Mountains of Russia and from the Karoo Basin in South Africa. The specimen count and analysis indicated that approximately 78 percent of land-based vertebrate genera perished in the end-Permian mass extinction. Out of the rubble emerged just a few species, the disaster taxa. One of these was *Lystrosaurus*, a dicynodont synapsid (related to mammals) about the size of a German shepherd. This creature barely registered during the Permian but dominated the ecosystem following the end-Permian extinction, the fossil record showed. Why *Lystrosaurus* survived the cataclysm when most others did not is a mystery, perhaps a combination of luck and not being picky about what it ate or where it lived. Similarly, a reptilian taxon, procolophonids, were mostly absent leading to the end-Permian extinction, yet exploded onto the scene afterward.

"Comparison with previous food-web modeling studies suggests this low diversity and prevalence of just a few taxa meant that links in the food web were few, causing instability in the ecosystem and making it susceptible to boom-bust cycles and further extinction," Whiteside said.

The ecosystems that emerged from the extinction had such low animal diversity that it was especially vulnerable to crashes spawned by environmental and other changes, the authors write. Only after species richness and evenness had been re-established, restoring enough population numbers and redundancy to the food web, did the terrestrial ecosystem fully recover. At that point, the carbon cycle, a broad indicator of life and death as well as the effect of outside influences, stabilized, the researchers note, using data from previous studies of carbon isotopes spanning the Permian and Triassic periods.

"These results are consistent with the idea that the fluctuating carbon cycle reflects the unstable ecosystems in the aftermath of the extinction event," Whiteside said.

The National Science Foundation and the University of Utah funded the work. Reporters and the general public have free access to the manuscript through an award from the University of Utah J. Willard Marriott Library Open Access Publishing Fund.

Story Source:

The above story is reprinted from materials provided by **Brown University**.

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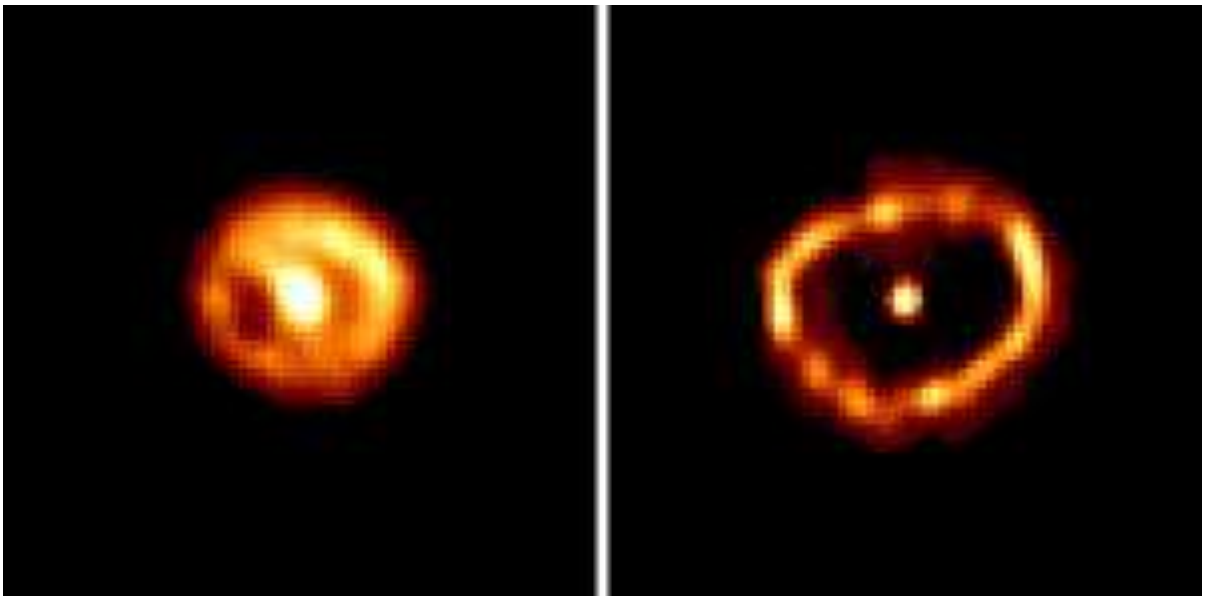
http://www.sciencedaily.com/releases/2011/10/111025210908.htm

3-D Simulations of Nova Explosions



Two images of Nova Cygni 1992 taken by the Hubble Space Telescope. (Credit: F. Paresce, R. Jedrzejewski (STScI), NASA/ESA)

ScienceDaily (Oct. 20, 2011) — A new study has shown how mixing of elements occurs during a nova explosion, thus solving an enigma that has puzzled stellar astrophysicists for over half a century.

Scientists at the Universitat Politècnica de Catalunya. BarcelonaTech (UPC) have for the first time simulated critical phenomena that occur during nova explosions. Their work has made it possible to precisely characterise the physical properties and chemical composition of the material ejected in novae, and this has yielded the solution to an enigma that has puzzled experts for over 50 years: the origin of the irregular, inhomogeneous distribution of nova ejecta.

The paper, published recently in *Nature*, has facilitated analysis of the role these thermonuclear explosions play in the chemical enrichment of the galaxy.

As a result of the complex nuclear phenomena that take place inside stars, the universe has evolved from a chemically poor state -- dominated exclusively by the presence of hydrogen, helium, and traces of lithium -- to one containing nearly a hundred stable elements. Without the variety of elements now present in the cosmos, the formation of structures like planets and stars and the genesis of live forms -- including the calcium in our bones, the iron in our blood, and the uranium we use in our nuclear power plants -- would have been impossible. Most of chemical elements originated in supernovae and novae, titanic stellar explosions.

Novae are cataclysmic stellar phenomena that take place in binary systems consisting of a compact stellar object (a white dwarf star the size of a planet but with a mass of up to 1.4 times that of the Sun) and a low-mass star. The stars must be close enough for the intense gravitational field of the white dwarf to tear material away from the outer layers of its companion.

Novae, which are relatively frequent in our galaxy (some 30 to 35 nova-like explosions occur each year), are the third most energetic stellar explosions in the universe, after supernovae and gamma-ray bursts.

Novae and supernovae have been observed by humans for over two thousand years. The way these stars suddenly become much brighter -- a change sometimes observable to the naked eye -- has given rise to a great variety of conjectures about their origin.

With the advent of new, more precise observational techniques (such as photometry and spectroscopy) experts have been able to precisely characterise some physical properties of the material ejected during nova explosions, such as its chemical composition. Scientists know that the material transferred by the companion star is often of solar composition (i.e., close to 98% hydrogen and helium by mass). But other elements, in the range between carbon (C) and calcium (Ca) on the periodic table, can account for 30% to 50% of the material ejected during a nova explosion.

The origin of this peculiar pattern of chemical abundances and their irregular distribution in nova ejecta is an enigma in the field of stellar astrophysics that has eluded explanation for almost half a century. According to the most likely hypothesis, when the material transferred by the companion star piles up on the white dwarf, mixing episodes occur at the interface between the outer layers of the white dwarf and the envelope of transferred material. But the characterisation of this mixing process has provoked vivid discussions. One of the proposed mechanisms could not be rigorously simulated until sufficiently powerful computational tools were available.

Simulations with the MareNostrum supercomputer

Now, a team of researchers led by Jordi Casanova, a PhD student, Jordi José, a Professor of Physics at UPC's Department of Physics and Nuclear Engineering, and Enrique García-Berro, Professor of Physics at the Department of Applied Physics, has shown that the accumulation of material on the white dwarf via this mechanism is unstable. This instability results in mixing episodes involving material at the interface between the outer layers of the white dwarf (rich in elements like carbon and oxygen, or oxygen and neon) and the envelope of transferred material. The researchers were also able to establish the extent of heavy-element enhancement caused by this phenomenon, which up to now had been deduced from observational data.

This phenomenon was demonstrated based on 3-D simulations of the mixing process, which the team performed for the first time for nova explosions. The simulations were possible thanks to the use of sophisticated tools like the MareNostrum computer at the Barcelona Supercomputing Centre -- Centro Nacional de Supercomputación (BSC-CNS), after 150,000 hours of calculation.

The possibility of recreating 3-D physical phenomena like convection under the conditions that prevail during nova explosions also led to a solution to the second part of the puzzle. Scientists already knew how energy transport by convection works in stars but could offer only a formal account of this phenomenon. Now, thanks to the study conducted by the UPC researchers, it has been numerically shown that, under the conditions that exist during a nova explosion, the matter (plasma) is in a turbulent state; its movement is unstructured, almost chaotic.

The intermittent nature of this turbulence results in irregularities in the chemical distribution of material in ejected envelopes. Up until now, this phenomenon had never been numerically tested in nova explosions (in fact it had not even been proposed as a hypothesis to explain the origin of the observed chemical heterogeneity). The heterogeneity was attributed until now to a lack of precision in the measuring process. The UPC study shows that this phenomenon is real, and that it is caused by the intermittent nature of the turbulent phenomena that occur in stellar plasma as it undergoes a thermonuclear explosion.

Researchers Jordi Casanova and Jordi José are attached to the Barcelona College of Industrial Engineering (EUETIB) and the Space Studies Institute of Catalonia; Enrique García-Berro is attached to the Castelldefels School of Telecommunications and Aerospace Engineering (EETAC) and the Space Studies Institute of Catalonia.

Steven Shore of the University of Pisa (Italy) and Alan Calder of Stony Brook University (USA) also participated in the project, which has received support from the Spanish Ministry of Science and Innovation, the Government of Catalonia (through the Agency for the Management of University and Research Grants), the European Union's ERDF programme, and the European Science Foundation.

Story Source:

The above story is reprinted from materials provided by **Universitat Politècnica de Catalunya (UPC)**.

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http://www.sciencedaily.com/releases/2011/10/111020122202.htm

Childhood poverty leaves its mark on adult genetics

- 16:30 26 October 2011 by **Andy Coghlan**
- For similar stories, visit the **Genetics** Topic Guide

Genes can be reset during early life in profoundly different ways depending on whether children grow up in privileged or deprived households, a landmark study has shown.

Although children in rich and poor households have very similar sets of genes, the scale of adversity at home dictates which combinations of those genes are switched on or silenced through a process called epigenesis – presumably to maximise the chance of survival.

"They may be protective responses, and the payoff is surviving a threatening childhood," says Marcus Pembrey from the University of Bristol, UK, who co-authored the study whilst working at University College London's Institute of Child Health.

The penalty might be activation of genes that make poorer people more prone to heart disease, diabetes, cancer and other diseases. That could help explain why poorer people often have shorter lives. Epigenetic changes have also recently been linked to conditions that can involve psychosis, including schizophrenia and bipolar disorder.

Haves and have-nots

Pembrey and his colleagues selected 40 men from a group of 3000 born in 1958 – half born into rich households and half born into poor ones. "We selected subjects from the top and bottom 20 per cent according to socioeconomic status, so ensuring we had examples of both extremes," says Pembrey.

The team took blood samples from the men when they were 45, and screened their DNA for any epigenetic changes. They were looking for chemical markings that either silence or activate individual genes. Genes that are methylated – those that have had extra methyl groups added at some stage – tend to be switched off, whereas demethylated groups – having lost methyl groups – are activated.

Focusing on stretches of DNA called promoter regions, which turn genes on or off, the team examined more than 20,000 sites throughout the genome. They found patterns that varied with the wealth or poverty of the men's childhood homes.

The patterns were different between the two groups at almost a third of the sites. Most tellingly, methylation levels were drastically different at 1252 sites if men came from poor households, but only at 545 sites in men from rich backgrounds.

"It's telling us that the epigenetic changes in adult DNA are largely from early life experience," says Pembrey.

Uncertain age

Because the samples were taken in middle age, the researchers couldn't tell exactly when the epigenetic methyl groups were added or subtracted. "We can't say whether the genes were altered in infancy, childhood, fetal life or even the previous generation," says Pembrey. But whenever they were added, they survived to middle age.

Next, Pembrey and his colleagues hope to find out when these changes happen by studying the stored blood of children who took part in the Avon Longitudinal Study of Parents and Children. This project has tracked since birth 14,000 people born in the Bristol area; most are now aged around 20. The blood samples, including cord blood, have been taken every few years. "We can see whether epigenetic patterns are constant from cord blood onwards, or pick up signals from the environment and get reset right up to puberty," says Pembrey.

Many of the affected genes, such as a group called MAP kinases, have functions relating to the signals accepted by cells. What's more, the epigenetic changes tended to be in defined clusters rather than random individual changes, suggesting that entire networks of genes were simultaneously silenced or activated epigenetically.

"They're like huge coordinated switches, as if the whole genome is flipping," says Pembrey. He speculates that the gene networks activated or silenced by these processes are then permanently embedded in the genome. This could cause alterations that blind people to external signals or make them more sensitive to them, he says. Such changes could make people unusually sensitive to threatening situations – useful if they encounter such situations regularly during childhood.

Down the generations

"The paper strengthens the idea that environmental conditions early in life can persistently modify the epigenome and may influence health," says Isabelle Mansuy of the University of Zurich in Switzerland. "But prenatal conditions may also play a role and cannot be excluded," she says.

Last year, Mansuy led a landmark study showing that epigenetic changes in mice deliberately stressed during childhood could be passed down to at least two generations of descendants.

Journal reference: *International Journal of Epidemiology*, DOI: 10.1093/ije/dyr147

http://www.newscientist.com/article/dn20255-childhood-poverty-leaves-its-mark-on-adult-genetics.html?full=true&print=true

Drug hallucinations look real in the brain

- 11:36 28 October 2011 by **Arran Froo**

The visions induced by an Amazonian brew used by shamans may be as real as anything the eyes actually see, according to brain scans of frequent users of the drug.

Draulio de Araujo of the Brain Institute at the Federal University of Rio Grande do Norte in Natal, Brazil, and colleagues recruited 10 frequent users of the brew – called ayahuasca. They asked the volunteers to look at images of people or animals while their brains were scanned using functional MRI, then asked the volunteers to close their eyes and imagine they were still viewing the image. Unsurprisingly, the researchers found that neural activity in the primary visual cortex dropped off when volunteers imagined seeing the image rather than actually viewing it.

But when the team then gave the volunteers a dose of ayahuasca and repeated the experiment, they found that the level of activity in the primary visual cortex was virtually indistinguishable when the volunteers were really viewing an image and when they were imagining it. This means visions seen have a real, neurological basis, says de Araujo – they are not made up or imagined.

Michael Brammer, head of the brain imaging unit at King's College London, says the study's statistics appear to indicate something relatively robust. However, he says it's difficult to pin down whether the eyes-closed responses on the drug are quantitatively the same as normal, eyes-open neural activity. "Functional MRI is not a one-to-one mapping of cerebral activity. If it were, things would be easier," he says.

Robin Carhart-Harris of Imperial College London has done similar fMRI work using the "magic mushroom" hallucinogen psilocybin. He says the results also have practical implications, such as for the application of psychedelics in psychotherapy.

Ayahuasca may also find its way into the psychiatrist's drug kit. The pharmacology of its ingredients tallies with the way some conventional drugs work; because of this, researchers are interested in ayahuasca's potential for treating addiction, depression or conditions such as post-traumatic stress disorder. One of the brew's two ingredients is the vine *Banisteriopsis caapi*, which contains chemicals that act as monoamine oxidase inhibitors – a major class of antidepressant drugs. The other ingredient is the shrub *Psychotria viridis*: it contains the powerful hallucinogen DMT (dimethyltryptamine), which acts on the mood-altering serotonergic system, the target of antidepressants such as Prozac.

Journal reference: *Human Brain Mapping*, DOI: 10.1002/hbm.21381

http://www.newscientist.com/article/dn20978-drug-hallucinations-look-real-in-the-brain.html

Face-To-Face With an Ancient Human

Top: Scanning the skull -- The Viste Boy's skull is very fragile and consists of many fragments. Scanning the skull is done with a laser surface scanner, and the resulting information is loaded into a computer programme. Right: Reconstructing the face -- After her programming, Ms Barber could convert the digital construct into a plastic model and then shape muscle, skin and features in clay. Bottom: Final model -- The final face is cast in plastic resin and fibreglass. The result is painted, and glass eyes set in. (Credit: Top: Terje Tveit / Right: Jenny Barber / Bottom: Jenny Barber)

ScienceDaily (Oct. 20, 2011) — A reconstruction based on the skull of Norway's best-preserved Stone Age skeleton makes it possible to study the features of a boy who lived outside Stavanger 7,500 years ago.

"It is hoped that this reconstruction is a good likeness and that, if someone who knew him in life had been presented with this restoration, they would hopefully have recognised the face," says Jenny Barber, an MSc student at the University of Dundee in Scotland.

She has scientifically rebuilt the face of the strong and stocky Viste Boy, who lived in the Vistehola cave near Stavanger, so that people can now look him right in the eye.

Ms Barber is studying forensic art, an unusual discipline embracing such elements as human anatomy and identification in order to recreate the appearance of an actual person.

This modelling method is primarily employed to assist police investigations, and is little known or used in Norway. But the country's most extensive reconstruction of a Stone Age skeleton has now been achieved.

Complete

Discovered in 1907, the Viste Boy represents the most complete Norwegian Stone Age skeleton and the third oldest human remains ever found in the Norway.

His dark-coloured skull and bones are currently on display in a glass case at the Archaeological Museum on the University of Stavanger (UiS).

Analyses show that the Viste Boy was approximately 15 when he died. He stood a bit less than 1.25 metres tall and probably lived in a group of 10-15 people.

From their studies of rubbish in and around Vistehola, the archaeologists determined that this clan ate fish -- mostly cod -- as well as oysters, mussels, cormorants, elk and wild pig.

They also thought that the teenager might have been sickly, which would explain his early death.

Woman

The oldest of Norway's known skeletons from the Stone Age belonged to a woman and was discovered at Søgne near Kristiansand in 1994. Her skull has been dated to 8,600 years ago.

She was the subject of Norway's first and hitherto only reconstruction of such ancient bones, which was exhibited at the University of Oslo's Museum of Art History in 1997.

This model was based on data from a series of skull X-rays, which allowed specialists at University College in London to build a three-dimensional recreation.

But reconstruction techniques are steadily improving, and the model of the Viste Boy reproduces his features differently than with the Søgne woman.

"The goal has been to create something as similar as possible to the original," explains Ms Barber. "That's what facial reconstruction is all about -- identification and recognition of a unique person."

Scanned

She has scanned the skull belonging to the long-dead youth with a laser surface scanner, which provided accurate data on his anatomy.

The cranium had suffered some damage, so the most complete side was duplicated. To support her work, Ms Barber also drew on a digital copy of the skull of another 15-year-old boy.

Nevertheless, the final anatomy corresponds to all intents and purposes with the original bone.

After her programming, Ms Barber could convert the digital construct into a plastic model and then shape muscle, skin and features in clay.

The clay bust formed the basis for a negative mould, with the finished product then cast in plastic resin and fibreglass. Eyes, ears and other details were finally painted or added.

Deformity

Ms Barber's work revealed that the Viste Boy had scaphocephaly ("boat-head"), a congenital deformity which makes the skull long and narrow. She left the modelled head hairless to show this.

"The fact that the boy had scaphocephaly is a medical detail we hadn't observed before," says Mads Ravn, head of research at the Archaeological Museum.

He is very enthusiastic about the job Ms Barber has done, and points to similar work at Denmark's Moesgård Museum to reconstruct the Grauballe Man -- a body recovered from a Danish bog.

He turned out to have a very protruding jaw and close-set eyes, which prompted the theory that he was an executed outcast or criminal, rather than a rich man sacrificed to the gods.

It was also clear that -- like the Tollund Man, another "bog body" -- resembled many contemporary Danes.

The work done by Ms Barber on the Viste Boy also demonstrates that the stocky lad was no weakling.

"This reconstruction indicates that he must have been muscular, quite simply a robust person," she observes. "So it's not certain that he was sickly, as people have thought.

"The bone analysis doesn't bear out such a diagnosis, and he has no other deformities that we know of other than the scaphocephaly."

Great

Apart from the more scientific findings, such as the scaphocephaly and the good muscles, Mr Ravn thinks it is great to be able to look such a remote forefather in the eye.

"Just imagine, we can get an idea of how the oldest Norwegian man looked."

He is also very pleased at the opportunities this reconstruction opens up for the museum.

"Our challenge in older archaeology is to present the finds in a good way. Ms Barber's work has given us a fantastic chance to convey flesh and blood through a very ancient relic."

The project is part of the Scientific Archaeological Laboratory research programme at the UiS, which emphasises lab work in cooperation with the museum's Department of Education and Visitor Service.

Ms Barber herself stresses the educational aspect as an important motivation for her work.

"People are drawn to faces. The Viste Boy will probably attract attention in a future exhibition at the museum, bringing the story of Vistehola, the Viste Boy and the other people who lived there more alive for visitors."

She adds that facial reconstruction has been used for educational purposes by museums in many parts of the world, but is not used to any great extent at Norwegian institutions.

The above story is reprinted from materials provided by **The University of Stavanger**. The original article was written by Karen Anne Okstad; translation by Rolf Gooderham.

http://www.sciencedaily.com/releases/2011/10/111020084819.htm

Prehistoric Greenhouse Data from Ocean Floor Could Predict Earth's Future, Study Finds

New research indicates that Atlantic Ocean temperatures during the greenhouse climate of the Late Cretaceous Epoch were influenced by circulation in the deep ocean. These changes in circulation patterns 70 million years ago could help scientists understand the consequences of modern increases in greenhouse gases. (Credit: © jim / Fotolia)

ScienceDaily (Oct. 27, 2011) — New research from the University of Missouri indicates that Atlantic Ocean temperatures during the greenhouse climate of the Late Cretaceous Epoch were influenced by circulation in the deep ocean. These changes in circulation patterns 70 million years ago could help scientists understand the consequences of modern increases in greenhouse gases.

"We are examining ocean conditions from several past greenhouse climate intervals so that we can understand better the interactions among the atmosphere, the oceans, the biosphere, and climate," said Kenneth MacLeod, professor of geological sciences in the College of Arts and Science. "The Late Cretaceous Epoch is a textbook example of a greenhouse climate on earth, and we have evidence that a northern water mass expanded southwards while the climate was cooling. At the same time, a warm, salty water mass that had been present throughout the greenhouse interval disappeared from the tropical Atlantic."

The study found that at the end of the Late Cretaceous greenhouse interval, water sinking around Greenland was replaced by surface water flowing north from the South Atlantic. This change caused the North Atlantic to warm while the rest of the globe cooled. The change started about five million years before the asteroid impact that ended the Cretaceous Period.

To track circulation patterns, the researchers focused on "neodymium," an element that is taken up by fish teeth and bones when a fish dies and falls to the ocean floor. MacLeod said the ratio of two isotopes of neodymium acts as a natural tracking system for water masses. In the area where a water mass forms, the water takes on a neodymium ratio like that in rocks on nearby land. As the water moves through the ocean, though, that ratio changes little. Because the fish take up the neodymium from water at the seafloor, the ratio in the fish fossils reflects the values in the area where the water sank into the deep ocean. Looking at changes through time and at many sites allowed the scientists to track water mass movements.

While high atmospheric levels of carbon dioxide caused Late Cretaceous warmth, MacLeod notes that ocean circulation influenced how that warmth was distributed around the globe. Further, ocean circulation patterns changed significantly as the climate warmed and cooled.

"Understanding the degree to which climate influences circulation and vice versa is important today because carbon dioxide levels are rapidly approaching levels most recently seen during ancient greenhouse times," said MacLeod. "In just a few decades, humans are causing changes in the composition of the atmosphere that are as large as the changes that took millions of years to occur during geological climate cycles."

The paper, "Changes in North Atlantic circulation at the end of the Cretaceous greenhouse interval," was published in the October online edition of the journal *Nature Geoscience*. Coauthors include C. Isaza Londoño of the University of Missouri; E.E. Martin and C. Basak of the University of Florida, and A. Jiménez Berrocoso of the Unviersity of Manchester, United Kingdom. The study was sponsored by the National Science Foundation.

Story Source:

The above story is reprinted from materials provided by **University of Missouri-Columbia**.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

Journal Reference:

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http://www.sciencedaily.com/releases/2011/10/111027150213.htm

Python Study May Have Implications for Human Heart Health

Leslie Leinwand. (Credit: Photo by Thomas Cooper)

ScienceDaily (Oct. 27, 2011) — A surprising new University of Colorado Boulder study shows that huge amounts of fatty acids circulating in the bloodstreams of feeding pythons promote healthy heart growth, results that may have implications for treating human heart disease.

CU-Boulder Professor Leslie Leinwand and her research team found the amount of triglycerides -- the main constituent of natural fats and oils -- in the blood of Burmese pythons one day after eating increased by more than fiftyfold. Despite the massive amount of fatty acids in the python bloodstream there was no evidence of fat deposition in the heart, and the researchers also saw an increase in the activity of a key enzyme known to protect the heart from damage.

After identifying the chemical make-up of blood plasma in fed pythons, the CU-Boulder researchers injected fasting pythons with either "fed python" blood plasma or a reconstituted fatty acid mixture they developed to mimic such plasma. In both cases, the pythons showed increased heart growth and indicators of cardiac health. The team took the experiments a step further by injecting mice with either fed python plasma or the fatty acid mixture, with the same results.

"We found that a combination of fatty acids can induce beneficial heart growth in living organisms," said CU-Boulder postdoctoral researcher Cecilia Riquelme, first author on the Science paper. "Now we are trying to

understand the molecular mechanisms behind the process in hopes that the results might lead to new therapies to improve heart disease conditions in humans."

The paper is being published in the Oct. 28 issue of the journal Science. In addition to Leinwand and Riquelme, the authors include CU postdoctoral researcher Brooke Harrison, CU graduate student Jason Magida, CU undergraduate Christopher Wall, Hiberna Corp. researcher Thomas Marr and University of Alabama Tuscaloosa Professor Stephen Secor.

Previous studies have shown that the hearts of Burmese pythons can grow in mass by 40 percent within 24 to 72 hours after a large meal, and that metabolism immediately after swallowing prey can shoot up by fortyfold. As big around as telephone poles, adult Burmese pythons can swallow prey as large as deer, have been known to reach a length of 27 feet and are able to fast for up to a year with few ill effects.

There are good and bad types of heart growth, said Leinwand, who is an expert in genetic heart diseases including hypertrophic cardiomyopathy, the leading cause of sudden death in young athletes. While cardiac diseases can cause human heart muscle to thicken and decrease the size of heart chambers and heart function because the organ is working harder to pump blood, heart enlargement from exercise is beneficial.

"Well-conditioned athletes like Olympic swimmer Michael Phelps and cyclist Lance Armstrong have huge hearts," said Leinwand, a professor in the molecular, cellular and developmental biology department and chief scientific officer of CU's Biofrontiers Institute. "But there are many people who are unable to exercise because of existing heart disease, so it would be nice to develop some kind of a treatment to promote the beneficial growth of heart cells."

Riquelme said once the CU team confirmed that something in the blood plasma of pythons was inducing positive cardiac growth, they began looking for the right "signal" by analyzing proteins, lipids, nucleic acids and peptides present in the fed plasma. The team used a technique known as gas chromatography to analyze both fasted and fed python plasma blood, eventually identifying a highly complex composition of circulating fatty acids with distinct patterns of abundance over the course of the digestive process.

In the mouse experiments led by Harrison, the animals were hooked up to "mini-pumps" that delivered low doses of the fatty acid mixture over a period of a week. Not only did the mouse hearts show significant growth in the major part of the heart that pumps blood, the heart muscle cell size increased, there was no increase in heart fibrosis -- which makes the heart muscle more stiff and can be a sign of disease -- and there were no alterations in the liver or in the skeletal muscles, he said.

"It was remarkable that the fatty acids identified in the plasma-fed pythons could actually stimulate healthy heart growth in mice," said Harrison. The team also tested the fed python plasma and the fatty acid mixture on cultured rat heart cells, with the same positive results, Harrison said.

The CU-led team also identified the activation of signaling pathways in the cells of fed python plasma, which serve as traffic lights of sorts, said Leinwand. "We are trying to understand how to make those signals tell individual heart cells whether they are going down a road that has pathological consequences, like disease, or beneficial consequences, like exercise," she said.

The prey of Burmese pythons can be up to 100 percent of the constricting snake's body mass, said Leinwand, who holds a Marsico Endowed Chair of Excellence at CU-Boulder. "When a python eats, something extraordinary happens. Its metabolism increases by more than fortyfold and the size of its organs increase significantly in mass by building new tissue, which is broken back down during the digestion process."

The three key fatty acids in the fed python plasma turned out to be myristic acid, palmitic acid and palmitoleic acid. The enzyme that showed increased activity in the python hearts during feeding episodes, known as superoxide dismutase, is a well-known "cardio-protective" enzyme in many organisms, including humans, said Leinwand.

The new Science study grew out of a project Leinwand began in 2006 when she was named a Howard Hughes Medical Institute Professor and awarded a four-year, $1 million undergraduate education grant from the Chevy Chase, Md.-based institute. As part of the award Leinwand initiated the Python Project, an undergraduate laboratory research program designed to focus on the heart biology of constricting snakes like pythons thought to have relevance to human disease.

Undergraduates contributed substantially to the underpinnings of the new python study both by their genetic studies and by caring for the lab pythons, said Leinwand. While scientists know a great deal about the genomes of standard lab animal models like fruit flies, worms and mice, relatively little was known about pythons. "We have had to do a lot of difficult groundwork using molecular genetics tools in order to undertake this research," said Leinwand.

CU-Boulder already had a laboratory snake facility in place, which contributed to the success of the project, she said.

"The fact that the python study involved faculty, postdoctoral researchers, a graduate student and an undergraduate, Christopher Wall, shows the project was a team effort," said Leinwand. "Chris is a good example of how the University of Colorado provides an incredible educational research environment for undergraduates." Wall is now a graduate student at the University of California, San Diego.

Hiberna Corp., a Boulder-based company developing drugs based on natural models of extreme metabolic regulation, signed an exclusive agreement with CU's Technology Transfer Office in 2008, licensing technology developed by Leinwand based on the natural ability of pythons to dramatically increase their heart size and metabolism.

Directed by Nobel laureate and CU Distinguished Professor Tom Cech, the Biofrontiers Institute was formed to advance human health and welfare by exploring critical areas of biology and translating new knowledge into practical applications. The institute is educating a new generation of interdisciplinary scientists to work together on solutions to complex biomedical challenges and to expand Colorado's leadership in biotechnology. For more information on the Biofrontiers Institute visit cimb.colorado.edu .

Story Source:

The above story is reprinted from materials provided by **University of Colorado at Boulder**.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

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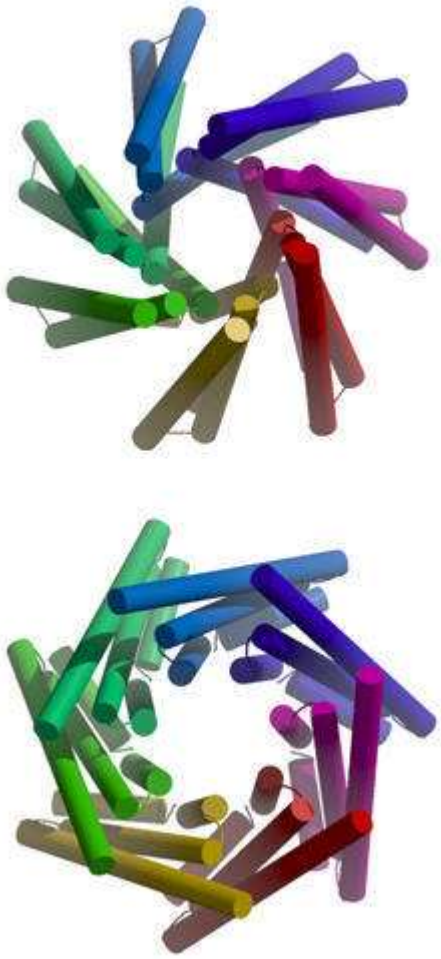
http://www.sciencedaily.com/releases/2011/10/111027145847.htm

Plants Feel the Force: How Plants Sense Touch, Gravity and Other Physical Forces



Representations of the pore section of the MscS channel in E. coli in its nonconducting (top) and open (bottom) configurations are based on X-ray crystallization studies of the protein's structure. The transition between closed and open states is often described as similar to the narrowing and expanding of the pupil of the eye. The "closed" state can still appear to have an opening because amino acids around the opening act as a "hydrophobic plug" that prevents ions from moving through it. (Credit: Image courtesy of Washington University in St. Louis)

ScienceDaily (Oct. 21, 2011) — "Picture yourself hiking through the woods or walking across a lawn," says Elizabeth Haswell, PhD, assistant professor of biology in Arts & Sciences at Washington University in St. Louis. "Now ask yourself: Do the bushes know that someone is brushing past them? Does the grass know that it is being crushed underfoot? Of course, plants don't think thoughts, but they do respond to being touched in a number of ways."

"It's clear," Haswell says, "that plants can respond to physical stimuli, such as gravity or touch. Roots grow down, a 'sensitive plant' folds its leaves, and a vine twines around a trellis. But we're just beginning to find out how they do it," she says.

In the 1980s, work with bacterial cells showed that they have mechanosensitive channels, tiny pores in the cells membrane that open when the cell bloats with water and the membrane is stretched, letting charged atoms and other molecules rush out of the cell. Water follows the ions, the cell contracts, the membrane relaxes, and the pores close.

Genes encoding seven such channels have been found in the bacterium *Escherichia coli* and 10 in *Arabidopsis thaliana*, a small flowering plant related to mustard and cabbage. Both *E. coli* and *Arabidopsis* serve as model organisms in Haswell's lab.

She suspects that there are many more channels yet to be discovered and that they will prove to have a wide variety of functions.

Recently, Haswell and colleagues at the California Institute of Technology, who are co-principal investigators on an National Institutes of Health (NIH) grant to analyze mechanosensitive channels, wrote a review article about the work so far in order to "get their thoughts together" as they prepared to write the grant renewal. The review appeared in the Oct. 11 issue of *Structure*.

Swelling bacteria might seem unrelated to folding leaflets, but Haswell is willing to bet they're all related and that mechanosensitive ion channels are at the bottom of them all. After all, plant movements -- both fast and slow -- are ultimately all hydraulically powered; where ions go the water will follow.

Giant *E. coli* cells

The big problem with studying ion channels has always been their small size, which poses formidable technical challenges.

Early work in the field, done to understand the ion channels whose coordinated opening and closing creates a nerve impulse, was done in exceptionally large cells: the giant nerve cells of the European squid, which had projections big enough to be seen with the unaided eye.

Experiments with these channels eventually led to the development of a sensitive electrical recording technique known as the patch clamp that allowed researchers to examine the properties of a single ion channel. Patch clamp recording uses as an electrode a glass micropipette that has an open tip. The tip is small enough that it encloses a "patch" of cell membrane that often contains just one or a few ion channels.

Patch clamp work showed that there were many different types of ion channels and that they were involved not just in the transmission of nerve impulses but also with many other biological processes that involve rapid changes in cells.

Mechanosensitive channels were discovered when scientists started looking for ion channels in bacteria, which wasn't until the 1980s because ion channels were associated with nerves and bacteria weren't thought to have a nervous system.

In *E. coli*, the ion channels are embedded in the plasma membrane, which is inside a cell wall, but even if the wall could be stripped away, the cells are far too small to be individually patched. So the work is done with specially prepared giant bacterial cells called spherophlasts.

These are made by culturing *E. coli* in a broth containing an antibiotic that prevents daughter cells from separating completely when a cell divides. As the cells multiply, "snakes" of many cells that share a single plasma membrane form in the culture. "If you then digest away the cell wall, they swell up to form a large sphere," Haswell says.

Not that spheroplasts are that big. "We're doing most of our studies in *Xenopus* oocytes (frog eggs), whose diameters are 150 times bigger than those of spheroplasts," she says.

Three mechanosensitive channel activities

To find ion channels in bacteria, scientists did electrophysiological surveys of spheroplasts. They stuck a pipette onto the spheroplast and applied suction to the membrane as they looked for tiny currents flowing across the membrane.

"What they found was really amazing," Haswell says. "There were three different activities that are gated (triggered to open) only by deformation of the membrane." (They were called "activities" because nobody knew their molecular or genetic basis yet.)

The three activities were named mechanosensitive channels of large (MscL), small (MscS) and mini (MscM) conductance. They were distinguished from one another by how much tension you had to introduce in order to get them to open and by their conductance.

One of the labs working with spheroplasts was led by Ching Kung, PhD, at the University of Wisconsin-Madison. The MscL protein was identified and its gene was cloned in 1994 by Sergei Sukharev, PhD, then a member of Kung's lab. His tour-de-force experiment, Haswell says, involved reconstituting fractions of the bacterial plasma membrane into synthetic membranes (liposomes) to see whether they would confer large-channel conductance.

In 1999, the gene encoding MscS was identified in the lab of Ian Booth, PhD, at the University of Aberdeen. Comparatively, little work has been done on the mini channel, which is finicky and often doesn't show up, Haswell says, though a protein contributing to MscM activity was recently identified by Booth's group.

Once both genes were known, researchers did knockout experiments to see what happened to bacteria that didn't have the genes needed to make the channels. What they found, says Haswell, was that if both the MscL and MscS genes were missing, the cells could not survive "osmotic downshock," the bacterial equivalent of water torture.

"The standard assay," Haswell says, "is to grow the bacteria for a couple of generations in a very salty broth, so that they have a chance to balance their internal osmolyte concentration with the external one." (Osmolytes are molecules that affect osmosis, or the movement of water into and out of the cell.) "They do this," she says, "by taking up osmolytes from the environment and by making their own."

"Then," she says, "you take these bacteria that are chockfull of osmolytes and throw them into fresh water. If they don't have the MscS and MscL proteins that allow them to dump ions to avoid the uncontrolled influx of water, they don't survive." It's a bit like dumping saltwater fish into a freshwater aquarium.

Why are there three mechanosenstivie channel activities? The currently accepted model, Haswell says is that the channels with the smaller conductances are the first line of defense. They open early in response to osmotic shock so that the channel of large conductance, through which molecules the cell needs can escape, doesn't open unless it is absolutely necessary. The graduated response thus gives the cell its best chance for survival.

Crystallizing the proteins

The next step in this scientific odyssey, figuring out the proteins' structures, also was very difficult. Protein structures are traditionally discovered by purifying a protein, crystallizing it out of a water solution, and then bombarding the crystal with X-rays. The positions of the atoms in the protein can be deduced from the X-ray diffraction pattern.

In a sense crystallizing a protein isn't all that different from growing rock candy from a sugar solution, but, as always, the devil is in the details. Protein crystals are much harder to grow than sugar crystals and, once grown, they are extremely fragile. They even can even be damaged by the X-ray probes used to examine them.

And to make things worse MscL and MscS span the plasma membrane, which means that their ends, which are exposed to the periplasm outside the cell and the cytoplasm inside the cell, are water-loving and their middle sections, which are stuck in the greasy membrane, are repelled by water. Because of this double nature it is impossible to precipitate membrane proteins from water solutions.

Instead the technique is to surround the protein with what have been characterized as "highly contrived detergents," that protect them -- but just barely -- from the water. Finding the magical balance can take as long as a scientific career.

The first mechanosensitive channel to be crystallized was MscL -- not the protein in *E. coli* but the analogous molecule (a homolog) from the bacterium that causes tuberculosis. This work was done in the lab of one of Haswell's co-authors, Douglas C. Rees a Howard Hughes investigator at the California Institute of Technology.

MscS from *E. coli* was crystallized in the Rees laboratory several years later, in 2002, and an MscS protein with a mutation that left it stuck in the presumed open state was crystallized in the Booth laboratory in 2008. "So now we have two crystal structures for MscS and two (from different bacterial strains) for MscL," Haswell says.

Of plants and mutants

Up to this point, mechanosensitive channels might not seem all that interesting because the lives of bacteria are not of supreme interest to us unless they are making us ill.

However, says, Haswell, in the early 2000s, scientists began to compare the genes for the bacterial channels to the genomes of other organisms and they discovered that there are homologous sequences not just in other bacteria but also in some multicellular organisms, including plants.

"This is where I got involved," she says. "I was interested in gravity and touch response in plants. I saw these papers and thought these homologs were great candidates for proteins that might mediate those responses."

"There are 10 MscS-homologs in *Arabidopsis* and no MscL homologs," she says. "What's more, different homologs are found not just in the cell membrane but also in chloroplast and mitochondrial membranes. "

The chloroplast is the light-capturing organelle in a plant cell and the mitochondria is its power station; both are thought to be once-independent organisms that were engulfed and enslaved by cells which found them useful. Their membranes are vestiges of their free-living past.

The number of homologs and their locations in plant cells suggests these channels do much more than prevent the cells from taking on board too much water.

So what exactly were they doing? To find out Haswell got online and ordered *Arabidopsis* seeds from the Salk collection in La Jolla, Calif., each of which had a mutation in one of the 10 channel genes.

From these mutants she's learned that two of the ten channels control chloroplast size and proper division as well as leaf shape. Plants with mutations in these two MscS channel homologs have giant chloroplasts that haven't divided properly. The monster chloroplasts garnered her lab the cover of the August issue of *The Plant Cell.*

"We showed that bacteria lacking MscS and MscL don't divide properly either,"Haswell says, "so the link between these channels and division is evolutionarily conserved."

The big idea

But Haswell and her co-authors think they are only scratching the surface. "We are basing our understanding of this class of channels on MscS itself, which is a very reduced form of the channel," she says. "It's relatively tiny."

"But we know that some of the members of this family have long extensions that stick out from the membrane either outside or inside the cell. We suspect this means that the channels not only discharge ions, but that they also signal to the whole cell in other ways. They may be integrated into common signaling pathways, such as the cellular osmotic stress response pathway.

We think we may be missing a lot of complexity by focusing too exclusively on the first members of this family of proteins to be found and characterized," she says. "We think there's a common channel core that makes these proteins respond to membrane tension but that all kinds of functionally relevant regulation may be layered on top of that."

"For example," she says, "there's a channel in *E. coli* that's closely related to MscS that has a huge extension outside the cell that makes it sensitive to potassium. So it's a mechanosensitive channel but it only gates in the presence of potassium. What that's important for, we don't yet know, but it tells us there are other functions out there we haven't studied."

What about the sensitive plant?

So are these channels at the bottom of the really fast plant movements like the sensitive plant's famous touch shyness? (To see a movie of this and other "nastic" (fast) movements, go to the Plants in Motion site maintained by Haswell's colleague Roger P. Hangartner of Indiana University).

Haswell is circumspect. "It's possible," she says. "In the case of *Mimosa pudica* there's probably an electrical impulse that triggers a loss of water and turgor in cells at the base of each leaflet, so these channel proteins are great candidates.

Story Source:

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Note: Materials may be edited for content and length. For further information, please contact the source cited above.

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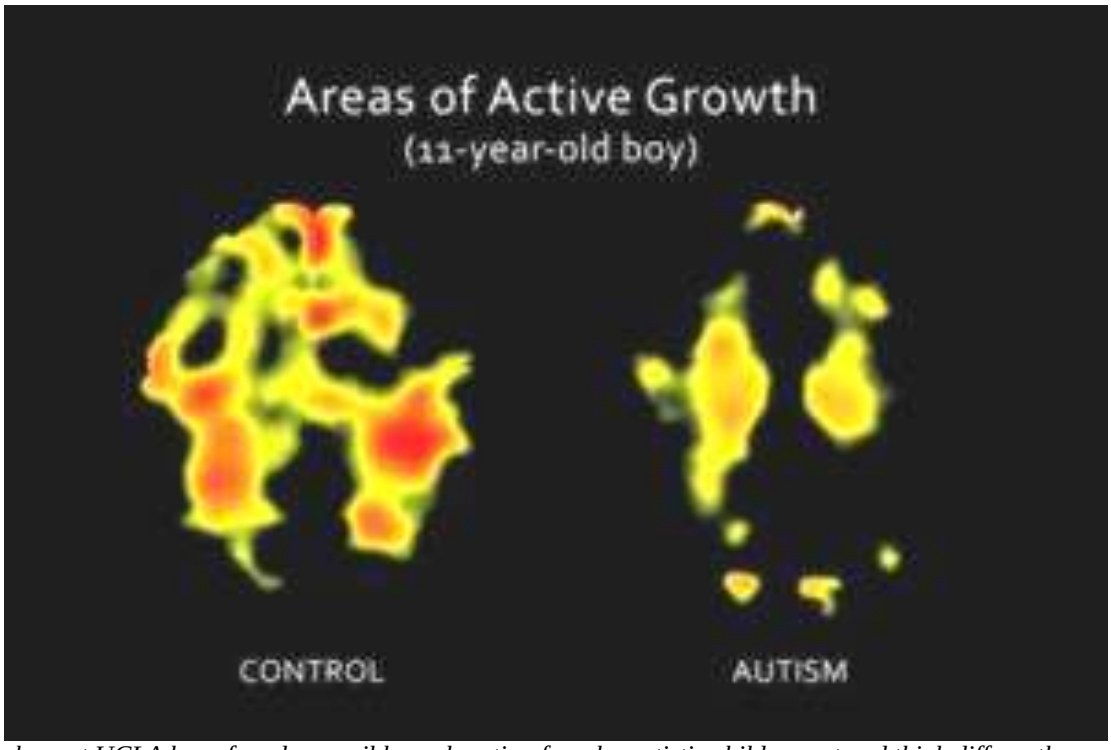
Autistic Brains Develop More Slowly Than Healthy Brains, Researchers Say



Researchers at UCLA have found a possible explanation for why autistic children act and think differently than their peers. For the first time, they've shown that the connections between brain regions that are important for language and social skills grow much more slowly in boys with autism than in non-autistic children. (Credit: Carlos Mena, Courtesy of University of California - Los Angeles)

ScienceDaily (Oct. 20, 2011) — Researchers at UCLA have found a possible explanation for why autistic children act and think differently than their peers. For the first time, they've shown that the connections between brain regions that are important for language and social skills grow much more slowly in boys with autism than in non-autistic children.

Reporting in the current online edition of the journal *Human Brain Mapping*, senior authorJennifer G. Levitt, a professor of psychiatry at the Semel Institute for Neuroscience and Human Behavior at UCLA; first author Xua Hua, a UCLA postdoctoral researcher; and colleagues found aberrant growth rates in areas of the brain implicated in the social impairment, communication deficits and repetitive behaviors that characterize autism.

Autism is thought to affect one in 110 children in the U.S., and many experts believe the numbers are growing. Despite its prevalence, little is known about the disorder, and no cure has been discovered.

Normally, as children grow into teenagers, the brain undergoes major changes. This highly dynamic process depends on the creation of new connections, called white matter, and the elimination, or "pruning," of unused brain cells, called gray matter. As a result, our brains work out the ideal and most efficient ways to understand and respond to the world around us.

Although most children with autism are diagnosed before they are 3 years old, this new study suggests that delays in brain development continue into adolescence.

"Because the brain of a child with autism develops more slowly during this critical period of life, these children may have an especially difficult time struggling to establish personal identity, develop social interactions and refine emotional skills," Hua said. "This new knowledge may help to explain some of the symptoms of autism and could improve future treatment options."

The researchers used a type of brain-imaging scan called a T1-weighted MRI, which can map structural changes during brain development. To study how the brains of boys with autism changed over time, they scanned 13 boys diagnosed with autism and a control group of seven non-autistic boys on two separate occasions. The boys ranged in age from 6 to 14 at the time of the first scan; on average, they were scanned again approximately three years later.

By scanning the boys twice, the scientists were able to create a detailed picture of how the brain changes during this critical period of development.

Besides seeing that the white-matter connections between those brain regions that are important for language and social skills were growing much slower in the boys with autism, they found a second anomaly: In two areas of the brain -- the putamen, which is involved in learning, and the anterior cingulate, which helps regulate both cognitive and emotional processing -- unused cells were not properly pruned away.

"Together, this creates unusual brain circuits, with cells that are overly connected to their close neighbors and under-connected to important cells further away, making it difficult for the brain to process information in a normal way," Hua said.

"The brain regions where growth rates were found to be the most altered were associated with the problems autistic children most often struggle with -- social impairment, communication deficits and repetitive behavior," she added.

Future studies using alternative neuroscience techniques should attempt to identify the source of this white-matter impairment, the researchers said.

"This study provides a new understanding of how the brains of children with autism are growing and developing in a unique way," Levitt said. "Brain imaging could be used to determine if treatments are successful at addressing the biological difference. The delayed brain growth in autism may also suggest a different approach for educational intervention in adolescent and adult patients, since we now know their brains are wired differently to perceive information."

Other authors on the study included Paul M. Thompson, Alex D. Leow, Sarah K. Madsen, Rochelle Caplan, Jeffry R. Alger, Joseph O'Neill, Kishori Joshi, Susan L. Smalley and Arthur W. Toga, all of UCLA. Support was provided by the National Institutes of Health, the National Alliance for Autism Research, the National Institute of Mental Health and the National Institute of Neurological Disorders and Stroke.

Story Source:

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http://www.sciencedaily.com/releases/2011/10/111020145104.htm

Extreme Melting On Greenland Ice Sheet, Team Reports; Glacial Melt Cycle Could Become Self-Amplifying

Marco Tedesco standing on the edge of one of four moulins (drainage holes) he and his team found at the bottom of a supraglacial lake during the expedition to Greenland in the summer, 2011. (Credit: P. Alexander)

ScienceDaily (Oct. 25, 2011) — The Greenland ice sheet can experience extreme melting even when temperatures don't hit record highs, according to a new analysis by Dr. Marco Tedesco, assistant professor in the Department of Earth and Atmospheric Sciences at The City College of New York. His findings suggest that glaciers could undergo a self-amplifying cycle of melting and warming that would be difficult to halt.

"We are finding that even if you don't have record-breaking highs, as long as warm temperatures persist you can get record-breaking melting because of positive feedback mechanisms," said Professor Tedesco, who directs CCNY's Cryospheric Processes Laboratory and also serves on CUNY Graduate Center doctoral faculty.

Professor Tedesco and his team collected data for the analysis this past summer during a four-week expedition to the Jakobshavn Isbræ glacier in western Greenland. Their arrival preceded the onset of the melt season.

Combining data gathered on the ground with microwave satellite recordings and the output from a model of the ice sheet, he and graduate student Patrick Alexander found a near-record loss of snow and ice this year. The extensive melting continued even without last year's record highs.

The team recorded data on air temperatures, wind speed, exposed ice and its movement, the emergence of streams and lakes of melt water on the surface, and the water's eventual draining away beneath the glacier. This lost melt water can accelerate the ice sheet's slide toward the sea where it calves new icebergs. Eventually, melt water reaches the ocean, contributing to the rising sea levels associated with long-term climate change.

The model showed that melting between June and August was well above the average for 1979 to 2010. In fact, melting in 2011 was the third most extensive since 1979, lagging behind only 2010 and 2007. The "mass balance," or amount of snow gained minus the snow and ice that melted away, ended up tying last year's record values.

Temperatures and an albedo feedback mechanism accounted for the record losses, Professor Tedesco explained. "Albedo" describes the amount of solar energy absorbed by the surface (e.g. snow, slush, or

patches of exposed ice). A white blanket of snow reflects much of the sun's energy and thus has a high albedo. Bare ice -- being darker and absorbing more light and energy -- has a lower albedo.

But absorbing more energy from the sun also means that darker patches warm up faster, just like the blacktop of a road in the summer. The more they warm, the faster they melt.

And a year that follows one with record high temperatures can have more dark ice just below the surface, ready to warm and melt as soon as temperatures begin to rise. This also explains why more ice sheet melting can occur even though temperatures did not break records.

Professor Tedesco likens the melting process to a speeding steam locomotive. Higher temperatures act like coal shoveled into the boiler, increasing the pace of melting. In this scenario, "lower albedo is a downhill slope," he says. The darker surfaces collect more heat. In this situation, even without more coal shoveled into the boiler, as a train heads downhill, it gains speed. In other words, melting accelerates.

Only new falling snow puts the brakes on the process, covering the darker ice in a reflective blanket, Professor Tedesco says. The model showed that this year's snowfall couldn't compensate for melting in previous years. "The process never slowed down as much as it had in the past," he explained. "The brakes engaged only every now and again."

The team's observations indicate that the process was not limited to the glacier they visited; it is a large-scale effect. "It's a sign that not only do albedo and other variables play a role in acceleration of melting, but that this acceleration is happening in many places all over Greenland," he cautioned. "We are currently trying to understand if this is a trend or will become one. This will help us to improve models projecting future melting scenarios and predict how they might evolve."

Additional expedition team members included Christine Foreman of Montana State University, and Ian Willis and Alison Banwell of the Scott Polar Research Institute, Cambridge, UK.

Professor Tedesco and his team provide their preliminary results on the Cryospheric Processes Laboratory webpage (http://greenland2011.cryocity.org/). They will will be presenting further results at the American Geophysical Union Society (AGU) meeting in San Francisco on December 5 at 9 a.m. and December 6 at 11:35 a.m.

The research was supported by the National Science Foundation and the NASA Cryosphere Program. The World Wildlife Fund is acknowledged for supporting fieldwork activities.

The above story is reprinted from materials provided by **City College of New York**.

http://www.sciencedaily.com/releases/2011/10/111025163128.htm

Birthplace for Primitive Life On Earth? Researchers Identify Mud Volcanoes in Greenland as Niche for Early Life

Serpentinites from Isua (Greenland). (Credit: © F. Albarède)

ScienceDaily (Oct. 25, 2011) — The mud volcanoes at Isua, in south-west Greenland, have been identified as a possible birthplace for life on Earth by an international team headed by researchers from the Laboratoire de Géologie de Lyon: Terre, Planètes et Environnement (CNRS/Université Claude Bernard Lyon 1/ENS de Lyon). Almost four billion years ago, these volcanoes released chemical elements indispensable to the formation of the first biomolecules, under conditions favorable to life. It is the first time that such an environment, meeting all the requirements for the emergence of life, has been identified by scientists in 3.8 billion year- old formations.

This work is published this week in the *Proceedings of the National Academy of Sciences*.

Serpentinite is a dark green mineral used in decoration and jewelry. In nature, it is formed when sea water infiltrates into Earth's upper mantle, at depths that can reach 200 km in subduction zones. According to the scientists, this mineral, often found in the walls of hydrothermal sources, could play a major role in the appearance of the first biomolecules.

It has often been presumed that life developed near to hydrothermal sources known as black smokers(1), such as those found at the bottom of the oceans along mid-ocean ridges. The abundance of hydrogen, methane and ammonia produced by these underwater geysers seemed favorable to the emergence of primitive life. Unfortunately, these black smokers are very acid, which prevents amino-acid stabilization, and thus the formation of organic molecules.

The team of scientists publishing this article focused their studies on serpentinites from Isua, in south-west Greenland, which date from the start of the Archean(2). Dating back some 3.8 billion years, the rocks of Isua are some of the oldest in the world. Using isotopes of zinc as indicators of the basic or acid nature of an environment, the researchers highlighted the basic character of the thermal fluids that permeated the Isua serpentinites, thus demonstrating that these minerals formed a favorable environment for amino-acid stabilization.

The researchers also compared these serpentinites with recent equivalents from the mid-oceanic ridge of the Artic Ocean, the Alps and Mexico: the Isua rocks are markedly depleted in heavy isotopes of zinc compared to the latter. On the other hand, their zinc is isotopically similar to that from mud volcanoes of the Marianas Trench. Nearly four billion years ago, at a time when the continents only occupied a very small part of the surface area of the globe, the oceanic crust of Isua was permeated by basic hydrothermal fluids, rich in carbonates, and at temperatures ranging from 100 to 300°C. Phosphorus, another indispensable element to life, is abundant in environments where serpentinization takes place(3). As this process generates mud volcanoes, all the necessary conditions were gathered at Isua for organic molecules to form and be stable. The mud volcanoes at Isua thus represent a particularly favorable setting for the emergence of primitive terrestrial life.

Notes:

1. Black smokers are located on oceanic ridges. The black appearance of the water stems from the color of the iron and manganese salts that it contains.
2. The Archaen eon stretches between 4 and 2.5 billion years ago.
3. Hydration process which enables the formation of serpentinite.

Story Source:

The above story is reprinted from materials provided by **CNRS (Délégation Paris Michel-Ange)**, via AlphaGalileo.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

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1. M.-L. Pons, G. Quitte, T. Fujii, M. T. Rosing, B. Reynard, F. Moynier, C. Douchet, F. Albarede. **Early Archean serpentine mud volcanoes at Isua, Greenland, as a niche for early life**. *Proceedings of the National Academy of Sciences*, 2011; DOI: 10.1073/pnas.1108061108

http://www.sciencedaily.com/releases/2011/10/111025090340.htm

Stem-cell find breathes new life into lung repair

- 14:12 28 October 2011 by **Andy Coghlan**

There is new hope for heavy smokers, people with asthma and those with chronic lung scarring. Stem cells have been discovered that rapidly rebuild alveoli, the tiny air sacs in lungs – a finding that could herald new treatments for people with damaged lungs. Meanwhile, a signalling molecule that drives regeneration of lung tissue has also been found.

The hitherto unknown stem cells were identified after researchers infected mice with a variant of H1N1 almost identical to the one that caused the Spanish flu pandemic of 1918. Another variant of H1N1 caused the 2009 swine flu pandemic.

Other lung stem cells have been studied already, but they were grown from embryonic stem cells. The new cells occur naturally within the lungs.

Samples taken from the mice showed that straight after infection the virus destroyed over half the original tissue in alveoli – the sacs in lungs vital for absorbing oxygen from inhaled air. Just three months later, however, all the tissue had naturally repaired itself, thanks mainly to the newly discovered stem cells.

"We saw essentially pristine lungs at three months after a loss of 50 per cent of lung tissue," says Frank McKeon of the Genome Institute of Singapore, who led the team.

Multiply and repair

The stem cells multiplied rapidly, creating hundreds of times their original number within a week. Then they migrated to sites of damage where they formed pod-like structures as a prelude to becoming new air sacs.

McKeon's colleague, Wa Xian at the Institute of Medical Biology in Singapore, isolated similar cells from human lung tissue and found that they form the same pod-like structures.

McKeon says that they have probably not been discovered before because the damage caused by the flu virus is more amenable to repair than that caused by bleomycin, a drug usually used to deliberately damage mouse lungs in experiments.

McKeon says the best hope for treating damaged may be through identification of the key signalling molecules that order the cells to rapidly multiply and migrate to sites of damage. With his colleagues, McKeon is now screening potential growth factors in fluid from repair sites in the mouse lungs to work out which do the job. "There are probably 20 to 30 of these factors that we're looking at," he says.

Injecting the right growth factor could aid healing in people with both acute and chronic lung damage. "It's too early to say common lung diseases will be treatable, but it's a start, and there's a lot of potential," says McKeon.

Chemical boost

A different group of researchers has managed to identify one such chemical that can drive the regeneration of alveoli – a development also published this week.

"The key is that the blood vessels turn on the pathways for regeneration," says Shahin Rafii of Weill Cornell Medical College in New York City, who led the team. "The cells lining the vessels produce growth factors that trigger it, and the main one is MMP 14, standing for matrix metalloproteinase 14," he says.

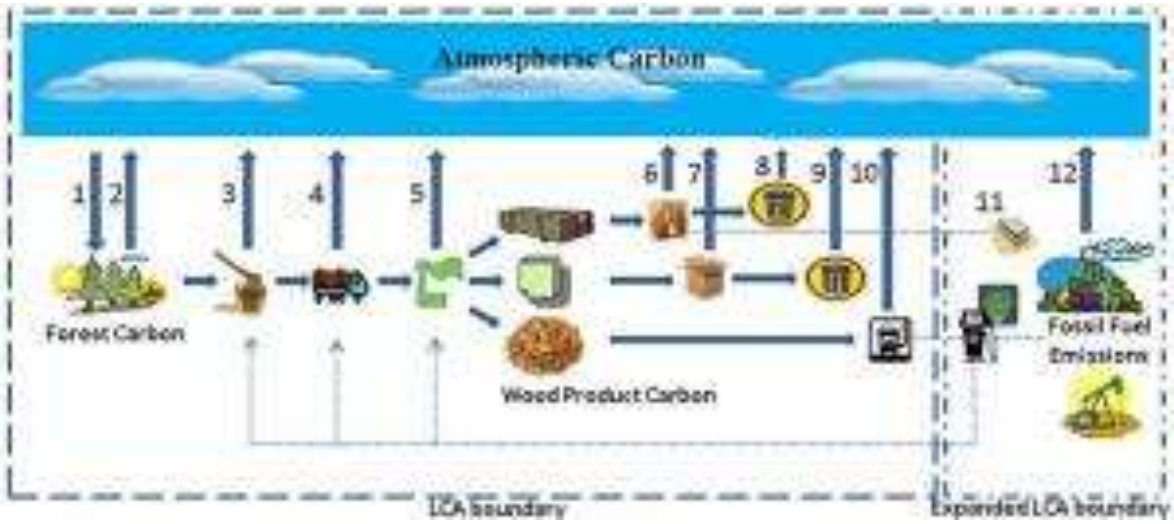
Rafii and his colleagues discovered the chemical when they removed one lung from mice, triggering extra alveoli to grow in the other lung. By deliberately blocking the effects of MMP 14, they demonstrated that it was the key factor needed for regeneration – although they did not explore exactly how regeneration occurred.

"The therapeutic potential is tremendous," says Rafii, who is hoping to develop treatments for smoking-related diseases and other illnesses that damage lungs. One option might be to extract cells from the lining of a patient's blood vessels, activate them to produce MMP 14, multiply them and reinject them into the patient.

Journal references: *Cell*; McKeon, DOI: 10.1016/j.cell.2011.10.001; Rafii, DOI: 10.1016/j.cell.2011.10.003

http://www.newscientist.com/article/dn21102-stemcell-find-breathes-new-life-into-lung-repair.html

Production of Biofuel from Forests Will Increase Greenhouse Gas Emissions, Study Finds



Forests and atmospheric carbon. A complete "life cycle analysis" outlines the various ways that wood products can be used and their influence on atmospheric carbon. (Credit: Graphic courtesy of Oregon State University)

ScienceDaily (Oct. 23, 2011) — The largest and most comprehensive study yet done on the effect of biofuel production from West Coast forests has concluded that an emphasis on bioenergy would increase carbon dioxide emissions from these forests at least 14 percent, if the efficiency of such operations is optimal.

The findings are contrary to assumptions and some previous studies that suggest biofuels from this source would be carbon-neutral or even reduce greenhouse gas emissions.

In this research, that wasn't true in any scenario.

The study was published in *Nature Climate Change*, by scientists from the College of Forestry at Oregon State University and other institutions in Germany and France. It was supported by the U.S. Department of Energy.

During the past four years, the study examined 80 forest types in 19 eco-regions in Oregon, Washington and California, ranging from temperate rainforests to semi-arid woodlands. It included both public and private lands and different forest management approaches.

"On the West Coast, we found that projected forest biomass removal and use for bioenergy in any form will release more carbon dioxide to the atmosphere than current forest management practices," said Tara Hudiburg, a doctoral candidate at OSU and lead author on the study.

"Most people assume that wood bioenergy will be carbon-neutral, because the forest re-grows and there's also the chance of protecting forests from carbon emissions due to wildfire," Hudiburg said. "However, our research showed that the emissions from these activities proved to be more than the savings."

The only exception to this, the researchers said, was if forests in high fire-risk zones become weakened due to insect outbreaks or drought, which impairs their growth and carbon sequestration, as well as setting the stage for major fires. It's possible some thinning for bioenergy production might result in lower emissions in such cases if several specific criteria are met, they said.

"Until now there have been a lot of misconceptions about impacts of forest thinning, fire prevention and biofuels production as it relates to carbon emissions from forests," said Beverly Law, a professor in the OSU Department of Forest Ecosystems and Society and co-author of this study.

"If our ultimate goal is to reduce greenhouse gas emissions, producing bioenergy from forests will be counterproductive," Law said. "Some of these forest management practices may also have negative impacts on soils, biodiversity and habitat. These issues have not been thought out very fully."

The study examined thousands of forest plots with detailed data and observations, considering 27 parameters, including the role of forest fire, emissions savings from bioenergy use, wood product substitution, insect infestations, forest thinning, energy and processes needed to produce biofuels, and many others.

It looked at four basic scenarios: "business as usual"; forest management primarily for fire prevention purposes; additional levels of harvest to prevent fire but also make such operations more economically feasible; and significant bioenergy production while contributing to fire reduction.

Compared to "business as usual" or current forest management approaches, all of the other approaches increased carbon emissions, the study found. Under the most optimal levels of efficiency, management just for fire prevention increased it 2 percent; for better economic return, 6 percent; and for higher bioenergy production, 14 percent.

"However, we don't believe that an optimal efficiency of production is actually possible in real-world conditions," Hudiburg said. "With levels of efficiency that are more realistic, we project that the use of these forests for high bioenergy production would increase carbon emissions 17 percent from their current level."

About 98 percent of the forests in this region are now estimated to be a carbon sink, meaning that even with existing management approaches they sequester more carbon than they release to the atmosphere.

Plans for greenhouse gas reduction call for up to 10 percent lower emissions by 2020, and forest-derived fuels are now seen as a carbon-neutral solution to reducing energy emissions, the researchers note. However, this study suggests that increases in harvest volume on the West Coast, for any reason, will instead result in average increases in emissions above current levels.

Forests capture a large portion of the carbon emitted worldwide, and some of this carbon is stored in pools such as wood and soil that can last hundreds to thousands of years, the scientists said.

"Energy policy implemented without full carbon accounting and an understanding of the underlying processes risks increasing rather than decreasing emissions," the researchers wrote in their report.

Story Source:

The above story is reprinted from materials provided by **Oregon State University**.

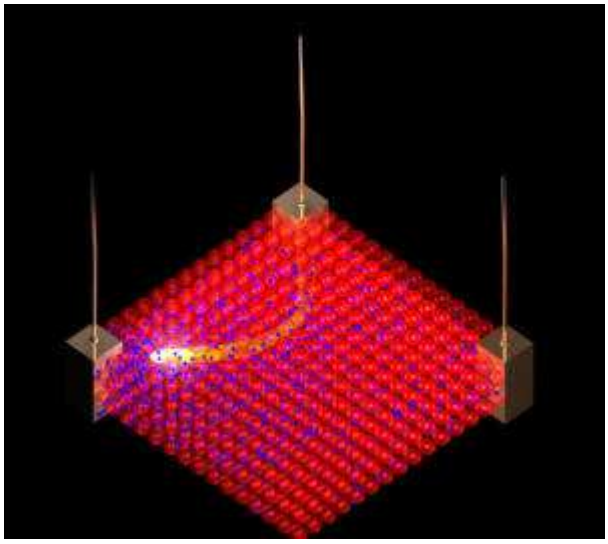
Note: Materials may be edited for content and length. For further information, please contact the source cited above.

Journal Reference:

1. Tara W. Hudiburg, Beverly E. Law, Christian Wirth, Sebastiaan Luyssaert. **Regional carbon dioxide implications of forest bioenergy production**. *Nature Climate Change*, 2011; DOI: 10.1038/nclimate1264

http://www.sciencedaily.com/releases/2011/10/111023135657.htm

Could a Computer One Day Rewire Itself? New Nanomaterial 'Steers' Electric Currents in Multiple Dimensions



By applying electrical pulses to the new nanomaterial, a sea of small negatively charged ions (blue) can be pushed and pulled between larger, positively charged nanoparticles (red) which are "jammed" in place. The regions of high and low ionic concentration allow for the material to become either more or less conductive in those areas. By controlling how the ions are distributed, one can control how current flows between electrodes. (Credit: Northwestern University)

ScienceDaily (Oct. 16, 2011) — Scientists at Northwestern University have developed a new nanomaterial that can "steer" electrical currents. The development could lead to a computer that can simply reconfigure its internal wiring and become an entirely different device, based on changing needs.

As electronic devices are built smaller and smaller, the materials from which the circuits are constructed begin to lose their properties and begin to be controlled by quantum mechanical phenomena. Reaching this physical barrier, many scientists have begun building circuits into multiple dimensions, such as stacking components on top of one another.

The Northwestern team has taken a fundamentally different approach. They have made reconfigurable electronic materials: materials that can rearrange themselves to meet different computational needs at different times.

"Our new steering technology allows use to direct current flow through a piece of continuous material," said Bartosz A. Grzybowski, who led the research. "Like redirecting a river, streams of electrons can be steered in multiple directions through a block of the material -- even multiple streams flowing in opposing directions at the same time."

Grzybowski is professor of chemical and biological engineering in the McCormick School of Engineering and Applied Science and professor of chemistry in the Weinberg College of Arts and Sciences.

The Northwestern material combines different aspects of silicon- and polymer-based electronics to create a new classification of electronic materials: nanoparticle-based electronics.

The study, in which the authors report making preliminary electronic components with the hybrid material, will be published online Oct. 16 by the journal *Nature Nanotechnology*. The research also will be published as the cover story in the November print issue of the journal.

"Besides acting as three-dimensional bridges between existing technologies, the reversible nature of this new material could allow a computer to redirect and adapt its own circuitry to what is required at a specific moment in time," said David A. Walker, an author of the study and a graduate student in Grzybowski's research group.

Imagine a single device that reconfigures itself into a resistor, a rectifier, a diode and a transistor based on signals from a computer. The multi-dimensional circuitry could be reconfigured into new electronic circuits using a varied input sequence of electrical pulses.

The hybrid material is composed of electrically conductive particles, each five nanometers in width, coated with a special positively charged chemical. (A nanometer is a billionth of a meter.) The particles are surrounded by a sea of negatively charged atoms that balance out the positive charges fixed on the particles. By applying an electrical charge across the material, the small negative atoms can be moved and reconfigured, but the relatively larger positive particles are not able to move.

By moving this sea of negative atoms around the material, regions of low and high conductance can be modulated; the result is the creation of a directed path that allows electrons to flow through the material. Old paths can be erased and new paths created by pushing and pulling the sea of negative atoms. More complex electrical components, such as diodes and transistors, can be made when multiple types of nanoparticles are used.

The title of the paper is "Dynamic Internal Gradients Control and Direct Electric Currents Within Nanostructured Materials." In addition to Grzybowski and Walker, other authors are Hideyuki Nakanishi, Paul J. Wesson, Yong Yan, Siowling Soh and Sumanth Swaminathan, from Northwestern, and Kyle J. M. Bishop, a former member of the Grzybowski research group, now with Pennsylvania State University.

Story Source:

The above story is reprinted from materials provided by **Northwestern University**, via EurekAlert!, a service of AAAS.

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Poor Neighborhoods Mean Fewer High School Grads

Growing up in poor neighborhoods significantly reduces the chances that a child will graduate from high school, sociologists say. Black children fare worst of all.

By Melinda Burns

A new study further solidifies the fact that growing up in a poor neighborhood adversely affects high school graduation rates, particularly among black children. (Hemera)

"There's a lot of talk about how we live in a post-racial society, but that certainly isn't true," says Geoffrey Wodtke, a sociologist at the University of Michigan who studies the effects of growing up in the bad part of town.

He and two other researchers tracked 2,100 children from age 1 to age 17, and they report that children growing up in neighborhoods with high levels of poverty and unemployment are much less likely to graduate from high school. While the results may seem expected, much of the previous research in the field had taken only snapshot measurements of such "neighborhood effects," coming up with small or no impacts on academic performance.

Black children, the new study shows, are seven times more likely than other children to grow up in the worst neighborhoods in the country. If they are stuck in the poorest neighborhoods from age 1 to 17, only 76 percent will graduate by age 20, compared to 96 percent of black children in affluent neighborhoods.

Of course, you don't have to be black to suffer from bad surroundings. Among non-black youth, 87 percent graduate from high school if they grow up in the poorest neighborhoods, compared to 95 percent from affluent neighborhoods.

The longer children spend in bad neighborhoods, the worse their chances of graduating from high school, the researchers found.

"Our results indicate that sustained exposure to disadvantaged neighborhoods — characterized by high poverty, unemployment, and welfare receipt; many female-headed households; and few well-educated adults — throughout the entire childhood life course has a devastating impact on the changes of graduating from high school," they wrote in the *American Sociological Review*.

The study by Wodtke and sociologists David Harding at the University of Michigan and Felix Elwert at the University of Wisconsin is the first to track the quality of children's neighborhoods every year throughout their entire childhood and adolescence. Wodtke and his colleagues drew on a University of Michigan database that tracked parental employment, income, marital status, education, and family size for the children from 1968 on. They dug up annual information about poverty, unemployment, welfare benefits, high school degrees and jobs based on the United States Census tracts where the children were living — not an easy task, as many families moved several times.

Poor neighborhoods are isolated and racially segregated, with none of the quality schools, day care, grocery stores, pharmacies, and parks that can help promote a child's development and academic achievement; and they are disproportionately smoggy, crime-ridden and dilapidated. All of these factors, the researchers note, have been linked to poor performance in school, often culminating in dropouts.

Dropout rates for black youth actually declined from 21 percent in 1972 to a historic low of 11 percent in 2005, according to Child Trends, a Washington D.C.-based research center. But, the center says, the drop is "at least in part related to increased incarceration rates among black male high school dropouts, which more than doubled between 1980 and 1999. …"

Wodtke, Harding and Elwert documented a staggering disparity between black children and all others in their rate of exposure to poor neighborhoods. At the age of 10, for example, they found that 69 percent of black children lived in the poorest 20 percent of neighborhoods in the United States, compared to only 15 percent of all other children. What's more, the disparities widened over time. From age 1 to 17, the proportion of blacks living in the most affluent 20 percent of neighborhoods remained unchanged at about 3 percent, while the proportion of all other children in the best neighborhoods increased from 13 percent to 21 percent.

"Children from poor families are doubly disadvantaged because they suffer the harmful effects of family poverty, and also they're more likely to live in poor neighborhoods, which is extremely harmful in its own right," Wodtke said. "The consequences of deindustrialization and disinvestment in urban communities have been devastating for the residents of those areas. Because of racial segregation and racial discrimination where employment is concerned, those effects are concentrated on black Americans."

http://www.miller-mccune.com/education/poor-neighborhoods-mean-fewer-high-school-grads-37159/

VISTA Finds New Globular Star Clusters and Sees Right Through the Heart of the Milky Way

This picture shows a comparison of the view of the newly discovered globular cluster VVV CL001 in visible (upper) and infrared light (lower). The infrared view, from the VISTA telescope, shows the new cluster very clearly for the first time and allows many of the component stars to be studied. The visible-light version was created from photographs taken through blue, red and infrared filters and forming part of the Digitized Sky Survey 2. The better-known and brighter globular cluster UKS 1 appears on the right. (Credit: ESO/D. Minniti/VVV Team and Digitized Sky Survey 2. Acknowledgement: Davide De Martin)

ScienceDaily (Oct. 20, 2011) — Two newly discovered globular clusters have been added to the total of just 158 known globular clusters in our Milky Way. They were found in new images from ESO's VISTA survey telescope as part of the Via Lactea (VVV) survey. This survey has also turned up the first star cluster that is far beyond the centre of the Milky Way and whose light has had to travel right through the dust and gas in the heart of our galaxy to get to us.

The dazzling globular cluster called UKS 1 dominates the right-hand side of the first of the new infrared images from ESO's VISTA survey telescope at the Paranal Observatory in Chile. But if you can drag your gaze away, there is a surprise lurking in this very rich star field -- a fainter globular cluster that was discovered in the data from one of VISTA's surveys. You will have to look closely to see the other star cluster, which is called VVV CL001: it is a small collection of stars in the left half of the image.

But VVV CL001 is just the first of VISTA's globular discoveries. The same team has found a second object, dubbed VVV CL002. This small and faint grouping may also be the globular cluster that is the closest known to the centre of the Milky Way. The discovery of a new globular cluster in our Milky Way is very rare. The last one was discovered in 2010, and only 158 globular clusters were known in our galaxy before the new discoveries.

These new clusters are early discoveries from the VISTA Variables in the Via Lactea (VVV) survey that is systematically studying the central parts of the Milky Way in infrared light. The VVV team is led by Dante Minniti (Pontificia Universidad Católica de Chile) and Philip Lucas (Centre for Astrophysics Research, University of Hertfordshire, UK).

As well as globular clusters, VISTA is finding many open, or galactic clusters, which generally contain fewer, younger, stars than globular clusters and are far more common. Another newly announced cluster, VVV

CL003, seems to be an open cluster that lies in the direction of the heart of the Milky Way, but much further away, about 15 000 light-years beyond the centre. This is the first such cluster to be discovered on the far side of the Milky Way.

Given the faintness of the newly found clusters, it is no wonder that they have remained hidden for so long; up until a few years ago, UKS 1 (seen in image a), which easily outshines the newcomers, was actually the dimmest known globular cluster in the Milky Way. Because of the absorption and reddening of starlight by interstellar dust, these objects can only be seen in infrared light and VISTA, the world's largest survey telescope, is ideally suited to searching for new clusters hidden behind dust in the central parts of the Milky Way [2].

One intriguing possibility is that VVV CL001 is gravitationally bound to UKS 1 -- making these two stellar groups the Milky Way's first binary globular cluster pair. But this could just be a line-of-sight effect with the clusters actually separated by a vast distance.

These VISTA pictures were created from images taken though near-infrared filters J (shown in blue), H (shown in green), and Ks (shown in red). The size of the images show only a small fraction of the full VISTA field of view.

Notes

[1] The discovery of the additional new clusters was just announced in San Juan, Argentina, during the first bi-national meeting of the Argentinian and Chilean astronomical associations.

[2] The tiny dust grains that form huge clouds within galaxies scatter blue light much more strongly than red and infrared light. As a result astronomers can see through the dust much more effectively if they study infrared light rather than the usual visible radiation that our eyes are sensitive to.

Story Source:

The above story is reprinted from materials provided by **ESO**.

http://www.sciencedaily.com/releases/2011/10/111020024145.htm

Grandma's Apple Pie Is Better Than Apple Pie

Researchers find that food products sell better when they're labeled with descriptive phrases that elicit warm family memories.

By Tom Jacobs

Patrons were significantly more likely to order the specially labeled dishes, such as "Grandma's Home-made Grilled Chicken." (texascooking/Flickr)

We don't have time to bake for our kids, so we buy them Mother's Cookies. We rarely dine with relatives, but we do enjoy Uncle Ben's rice and Auntie Anne's pretzels.

Newly published research from France confirms, the emotional tug of such labels is quite effective. Even in a country renowned for its sophisticated palates, evocative names can be the difference when choosing dinner.

Researchers Nicolas Guéguen and Céline Jacob of the Université de Bretagne-Sud performed an experiment at a restaurant in Brittany, a small establishment patronized primarily by traveling businesspeople. For 12 days, the researchers manipulated the menu, varying the names of specific dishes.

Depending on the day the diners stopped by, they were given the opportunity to order either a "Mixed Salad" (usual label), "Uncle Jean's Mixed Salad" (family label), "Classical Mixed Salad" (traditional label) or "French Country Mixed Salad" (patriotic label). Meat and fish dishes were given a similar variety of names, as was the apple pie.

The researchers found patrons were significantly more likely to order the specially labeled dishes. Descriptive phrases that elicit warm family memories, such as "Grandma's Home-made Grilled Chicken," sold particularly well.

The study was published in the journal *Food Quality and Preference* — which, come to think of it, may be more popular if renamed *Grandma's Old-Fashioned Food Research*.

http://www.miller-mccune.com/culture/grandmas-apple-pie-is-better-than-apple-pie-36693/

Culture in Humans and Apes Has the Same Evolutionary Roots, Researchers Show

Culture is not a trait that is unique to humans. By studying orangutan populations, a team of researchers headed by anthropologist Michael Krützen from the University of Zurich has demonstrated that great apes also have the ability to learn socially and pass them down through a great many generations. (Credit: Mure Wipfli, University of Zurich)

ScienceDaily (Oct. 20, 2011) — Culture is not a trait that is unique to humans. By studying orangutan populations, a team of researchers headed by anthropologist Michael Krützen from the University of Zurich has demonstrated that great apes also have the ability to learn socially and pass them down through a great many generations. The researchers provide the first evidence that culture in humans and great apes has the same evolutionary roots, thus answering the contentious question as to whether variation in behavioral patterns in orangutans are culturally driven, or caused by genetic factors and environmental influences.

In humans, behavioral innovations are usually passed down culturally from one generation to the next through social learning. For many, the existence of culture in humans is the key adaptation that sets us apart from animals. Whether culture is unique to humans or has deeper evolutionary roots, however, remains one of the unsolved questions in science. About ten years ago, biologists who had been observing great apes in the wild reported a geographic variation of behavior patterns that could only have come about through the cultural transmission of innovations, much like in humans. The observation triggered an intense debate among scientists that is still ongoing. To this day, it is still disputed whether the geographical variation in behavior is culturally driven or the result of genetic factors and environmental influences.

Humans are not the only ones to exhibit culture

Anthropologists from the University of Zurich have now studied whether the geographic variation of behavioral patterns in nine orangutan populations in Sumatra and Borneo can be explained by cultural transmission. "This is the case; the cultural interpretation of the behavioral diversity also holds for orangutans -- and in exactly the same way as we would expect for human culture," explains Michael Krützen, the first author of the study just published in Current Biology. The researchers show that genetic factors or environmental influences cannot explain the behavior patterns in orangutan populations. The ability to learn things socially and pass them on evolved over many generations; not just in humans but also apes. "It looks as if the ability to act culturally is dictated by the long life expectancy of apes and the necessity to be able to adapt to changing environmental conditions," Krützen adds, concluding that, "Now we know that the roots of

human culture go much deeper than previously thought. Human culture is built on a solid foundation that is many millions of years old and is shared with the other great apes."

Largest dataset for any great ape species

In their study, the researchers used the largest dataset ever compiled for a great ape species. They analyzed over 100,000 hours of behavioral data, created genetic profiles for over 150 wild orangutans and measured ecological differences between the populations using satellite imagery and advanced remote sensing techniques. "The novelty of our study," says co-author Carel van Schaik, "is that, thanks to the unprecedented size of our dataset, we were the first to gauge the influence genetics and environmental factors have on the different behavioral patterns among the orangutan populations."

When the authors examined the parameters responsible for differences in social structure and behavioral ecology between orangutan populations, environmental influences and, to a lesser degree, genetic factors played an important role, proving that the parameters measured were the right ones. This, in turn, was pivotal in the main question as to whether genetic factors or environmental influences can explain the behavioral patterns in orangutan populations. "That wasn't the case. As a result, we could prove that a cultural interpretation for behavioral diversity also holds true for orangutans," van Schaik concludes.

Story Source:

The above story is reprinted from materials provided by **University of Zurich**.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

Journal Reference:

1. Michael Krützen, Erik P. Willems, and Carel P. van Schaik. **Culture and Geographic Variation in Orangutan Behaviour**. *Current Biology*, October 20, 2011 DOI: 10.1016/j.cub.2011.09.017

http://www.sciencedaily.com/releases/2011/10/111020122313.htm

Viewing Illegal Immigration Through Desert Debris

In the litter scattered across the desert floor, professor Jason De León finds truths about the miserable business of illegal immigration.

By Eric Wagner

What looks like trash to others is, to Jason De León, the archaeology of undocumented migration — the visible remnants of a largely invisible phenomenon. (Michael Wells)

We don't see or hear the border patrol agents until they're almost on top of us. There are two of them, both white; one older and wiry, the other young and beefy. They are dressed in olive drab uniforms. The wiry one gives our little group of four the once-over. "We thought we might get some action today," he says, "but you guys look all right." He sounds just a touch disappointed.

"What are you all up to?" the beefy one asks.

"We're out for a hike," says Jason De León.

De León, 34, is an assistant professor of anthropology at the University of Michigan and the founder of an undertaking called the Undocumented Migrant Project. Since 2008, he has been studying illegal migration from Mexico into southern Arizona. He doesn't volunteer that information, though. It's more trouble than it's worth.

"Seen anyone out here?" the wiry one asks.

"Not yet," says Bob Kee. Kee is a volunteer in the Tucson Samaritans, a group whose members hike the most heavily used stretches of desert in search of migrants who might need food, water, or urgent medical attention. The Samaritans focus on preventing deaths and try to avoid either assisting or impeding the migrants on their trek. Covering Kee's backpack is a large red T-shirt emblazoned with a white cross and the word "Samaritanos." It is not subtle.

"You guys OK for water and food?" the wiry one asks.

"We have enough," Kee says. "How about you? Do you guys need any water or anything?"

"We're fine," the wiry one answers. A few beats pass in silence. "Well, we'd best be gettin' on," he finally says. "You folks have a nice hike."

As the two agents start to leave, the beefy one turns back. "If you find anything that might interest us, you be sure to tell us," he says.

We murmur that we will. The agent grins at us. He knows that we won't.

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For de león, the subject of migration across the southern border is both broadly American and narrowly personal. He is the grandson of an illegal immigrant, and he grew up in the border states of Texas and California. His parents were in the U.S. Army (his father was a staff sergeant, his mother a warrant officer), and being an army brat meant he moved a lot. "It creates a disposition toward understanding cultural differences," he says.

In 1995, De León started his undergraduate education at UCLA and immersed himself in anthropology and archaeology. "I'd always been interested in archaeology," he recalls, "even before I knew what it was." After graduating in 2001 with a major in anthropology, he moved across the country, enrolling at Pennsylvania State University for his graduate education. He earned his doctorate in 2008, having completed a dissertation titled "The Lithic Industries of San Lorenzo-Tenochtitlán: An Economic and Technological Study of Olmec Obsidian." It concerned the trade of obsidian blades (that is, blades made from volcanic glass). As part of his research, he had to pick through thousands of tiny rocks. "It was sometimes a struggle to stay excited," he says.

After De León earned his Ph.D., he decided to take a break from archaeology and accepted an offer to be a lecturer in anthropology at the University of Washington in Seattle. The job gave him the leeway to be an academic without having to bore into his immediate specialty. He embraced it, and taught, among other things, a popular course on the anthropology of rock 'n' roll. Since he had been the singer and songwriter for a punk band called Youth in Asia in the 1990s (and currently sings in an alt-country band called The Wilcox Hotel), the work tapped into something appealing and immediate.

Yet archaeology stayed with him. In 2007, while a graduate student, he had helped to excavate an Olmec site in Mexico. Many of the people working on the project had been migrants to the U.S., and he got to hear their stories. "I started to see that there was a lot more going on with migration than people knew," he says.

Then, some archaeologists who were working in southern Arizona mentioned to De León that they frequently had to dig through piles of what they saw as trash that migrants had left behind. "They said that I should do an archaeological study on that stuff," he says. "They were probably joking."

But he took their advice seriously and headed to the Coronado National Forest. He found sites littered with a few plastic water bottles under bushes or cactuses, and then others with hundreds of discarded shoes, clothes, backpacks. What was trash to others was, to him, the archaeology of undocumented migration — the visible remnants of a largely invisible phenomenon.

So he launched the Undocumented Migrant Project in 2009. Combining ethnographic research (in the form of collecting oral histories) and archeological research (combing through modern-day sites), it would be a long-term study of people and their cultures, through their artifacts. "I needed to find a way to get back to archaeology that I found personally meaningful," De León says. "This was also a way for it to be relevant to contemporary issues."

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We are standing in the coronado national forest, about 10 miles from the U.S.-Mexico border. Off to the northwest, Baboquivari Peak rises out of a distant mountain range. "Migrants make sure to keep it on their left as they walk," De León says. "If it's on the left, they know they're going north."

Each summer, De León travels to this part of Arizona to do field work. Today, we are just four, but De León often brings a larger group. In 2010, he became an assistant professor at the University of Michigan in Ann Arbor, and he often has students with him. They stay in Arivaca, a small town about 11 miles north of the border. From there, they hike out to map sites and collect artifacts — a process that frequently includes hauling out pounds of smelly debris in garbage bags. De León catalogs the items, trying to get a sense of the gender and age of the person carrying this camouflage backpack, or who wore through the sole of that knock-off Nike Air Jordan.

The artifacts are part of an evolving story. In the past, most migrants came to the United States through border cities, not through the wilderness. At the point of entry between San Diego and Tijuana, migrants often made what local Border Patrol agents called "banzai runs" — frantic dashes across the border, sometimes in groups as large as 50, into oncoming traffic on Interstate 5. But the number of agents has more than doubled since 2004, from 10,000 to 21,370, of which 18,000 are deployed along the U.S.-Mexico border. So, illegal attempts to cross the border are happening in increasingly remote areas.

Today, almost half of all migrants try to cross in the Sonoran Desert. It's prodigiously dry (less than 2 inches of rain annually in parts) and prodigiously hot (120 degrees Fahrenheit is not uncommon). Since 2001, more than 2,100 migrants have died here; last year was one of the worst on record, with 249 deaths. This, says De León, is one of the details lost in the recent spate of stories on the decline of illegal migration: fewer people may be crossing, but proportionally more of those who do cross are dying.

As we make our way through the desert, we come across countless empty packets of ephedrine pills and cans of energy drinks along with the water bottles. These are provided by *coyotes* (smugglers of migrants) in order to hurry people across the terrain. The water bottles are black, because migrants think that black will make the containers harder to detect. "There's a real lack of understanding of the true capacity and practices of the Border Patrol," De León says. "Agents use ground sensors now, aerial drones, thermal imaging — and the migrants still paint their bottles black."

When it comes to U.S. efforts to control the border, numbers don't always mean what they appear to mean, and rumors and misconceptions are rife. "Archaeology has been really helpful in demystifying the process," he says. The sites tell him a lot about how the migrants travel, providing details that interviews do not. Similarly, the interviews he conducts often clear up mysteries that emerge when De León is cataloging a site. The ethnography and archeology, he says, "feed back into each other very well." For example, De León knows through interviews why the water bottles are painted black. He also knows that six factories in Mexico make water bottles that are specially designed for desert crossings — gallon jugs the size and shape of Clorox

bottles. And several of those companies have started to sell their bottles made from black plastic. This is a change that has occurred within the past two years. “The objects themselves say a lot about the migration process,” De León says. One company even puts an outline of Baboquivari Peak on its label. As De León points out, wryly, it’s hard to get more obvious than that.

The factory-blackened bottles, camouflage clothes, and backpacks — all likely found in the well-stocked stalls in the Mexican border towns of Nogales and Altar — attest to an unmistakable professionalization in the border-jumping business. For De León, to see these products as discarded artifacts reminds him of the humanity beneath the politics.“I want to have a good data set,” he says. “But I also want to understand the real costs that migrants have to pay, so that their lives are less anonymous.”

We are about 20 yards above the trail, where there is a small, makeshift shrine: two branches tied together with rope to make a cross, leaning among a small pile of stones. Kee tells De León that he re-wrapped the cross with duct tape. The rope was fraying. “Technically,” De León tells me later, “when he did that, he changed an archaeological site.” He shrugs. “It happens.” Of course, by entering it into the record as is, one could add that instead of just being a migrant’s lonely gesture, it became evidence that an American was moved by his encounter, sufficiently so that he tried to preserve it.

“As archaeologists, we can sometimes be a little esoteric, or not very good at connecting our research to broader issues that everyday people can understand,” De León says. He is thrashing through a tangle of spindly ocotillo plants, also known as the devil’s coach whip. Each is more than 10 feet tall and leafy from recent rains. Two months ago, Kee found several human bones here, scattered about the hillside. He has been back several times, each time finding a few more bones. He collects them and takes them to a coroner, on the off chance that one day they might be identified. The four of us pick through the rocks and vegetation, gathering whatever bone chips and fragments lie next to the trail. De León finds a bicuspid. I find a 4-inch section of rib. It is a morbid search.

Such is the challenge of archaeology of the unfolding present. If this were purely a study site, De León would have laid a grid over the hillside. He would have had us go over the site on our hands and knees, square by square. Each bone we found would have been meticulously cataloged, its position noted with GPS. But we are in a more fluid space — not quite archaeological, not quite crime scene, not quite garbage dump, not quite wilderness. Kee brings out a small Ziploc, so that our bits and pieces can be added to the already gathered remains. We drop them in. They fill roughly half the bag.

http://www.miller-mccune.com/culture/viewing-illegal-immigration-through-desert-debris-36731/

Evidence for the Existence of a Hypnotic State? Key May Be in the Glazed Staring Eyes, Researchers Suggest

Eyes in the normal waking state (top) and under hypnosis (bottom). (Credit: Image courtesy of Suomen Akatemia (Academy of Finland))

ScienceDaily (Oct. 25, 2011) — A multidisciplinary group of researchers from Finland (University of Turku and Aalto University) and Sweden (University of Skövde) has found that the strange stare of patients under hypnosis may be a key that can eventually lead to a solution to a long debate about the existence of a hypnotic state.

One of the most widely known features of a hypnotized person in the popular culture is a glazed, wide-open look in the eyes. Paradoxically, this sign has not been considered to have any major importance among researchers and has never been studied in any detail, probably due to the fact that it can be seen in only some hypnotized people.

Published in the online journal *PLoS ONE,* the study was done with a very highly hypnotizable participant who can be hypnotized and dehypnotized by just using a one-word cue. The change between hypnotic state and normal state can thus be varied in seconds.

The researchers used high-resolution eye-tracking methodology and presented a set of well-established oculomotor tasks that trigger automatic eye behavior. They found the glazed stare was accompanied by objectively measurable changes in automatic, reflexive eye behavior that could not be imitated by non-hypnotized participants.

In the field of hypnosis research this result means that hypnosis can no longer be regarded as mental imagery that takes place during a totally normal waking state of consciousness. On the other hand, the result may have wider consequences for psychology and cognitive neuroscience, since it provides the first evidence of the existence of a conscious state in humans that has previously not been scientifically confirmed.

Hypnosis has had a long and controversial history in psychology, psychiatry and neurology. For over 100 years researchers have debated if a special hypnotic state exists or whether it is just about using cognitive strategies and mental imagery in a normal waking state. So far, a hypnotic state has never been convincingly demonstrated, and therefore, many researchers regard the hypnotic state to be just a popular myth in psychology.

Story Source:

The above story is reprinted from materials provided by **Suomen Akatemia (Academy of Finland)**, via AlphaGalileo.

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Journal Reference:

1. Sakari Kallio, Jukka Hyönä, Antti Revonsuo, Pilleriin Sikka, Lauri Nummenmaa. **The Existence of a Hypnotic State Revealed by Eye Movements**. *PLoS ONE*, 2011; 6 (10): e26374 DOI: 10.1371/journal.pone.0026374

http://www.sciencedaily.com/releases/2011/10/111025091559.htm

Falling Cost of Renewables Softens Nuclear Shutdown

As renewable energy sources approach cost parity with traditional sources, phasing out nuclear power might in Germany be economically smart.

By Michael Scott Moore

The economics of decommissioning nuclear and ramping up renewable energy is making sense in the European Union. (Ekhinos/Flickr.com)

When Germany decided this year to phase out its nuclear sector, eight of its 17 power plants were mothballed immediately, and Germans learned just how expensive it can be to shut down a reactor: about a billion euros.

That didn't surprise industry analysts, but it also doesn't include the cost of storing nuclear waste. So German power companies — though they'd been ordered to sock away enough cash to decommission their reactors — will probably ask the government for more help.

"Total costs [for all reactors] might yet top the €32.5 billion that companies have set aside for expenses relating to the shutdown," Reuters reported last week. "That is because the costs of storing nuclear waste produced during the lifetime of the 17 facilities are excluded from estimates." (With the euro fetching about US$1.33 this week, that's $43.3 billion.)

The eventual costs of turning off nuclear power should be a major line item in assessing its true costs in the first place. The uncertain (or deliberately ignored) costs of waste storage are one reason Chancellor Angela Merkel decided to shut down German reactors sooner rather than later. What she certainly knew — and what

nuclear advocates often fail to mention — is that nuclear power, no less than renewable energy, still needs cushy government support.

The overall cost of building modern nuclear plants also keeps rising, for a number of reasons (including safety regulations and the cost of high-tech reactors), while the cost of renewables falls. Connie Hedegaard, the European Union's climate change commissioner, came right out and said it last March, in the week after the Fukushima disaster: "Some people tend to believe that nuclear is very, very cheap," she said, "but offshore wind is cheaper than nuclear."

She was probably following the Green argument that costs for wind energy, with a sleek new turbines, has fallen below the kilowatt-hour cost of nuclear energy from sleek new reactors.

Whether the sinking costs of renewable technologies have met a historic crossover point with the rising costs of nuclear is controversial (and they probably haven't). But nuclear power plants can suffer from "dis-economies of scale," where prices rise absurdly after a plant crosses a certain size — often because the plant can generate too much electricity for a local market.

Meanwhile, solar energy prices have a long way to fall: German producers of solar panels complain that Chinese companies have managed to underprice them, which threatens Germany's huge advantage in photovoltaic manufacture. Prices over the last five years have collapsed by about 50 percent because of Chinese competition.

"The dramatic price change for solar modules is admittedly a burden for [Western] firms," the German magazine *Manager Magazin* wrote in August, "but that means the technology enjoys more demand than ever."

And it means solar energy could start to hold its own on the market: Germany's famous system of price subsidies may be on its way out. One reason for an overcast land like Germany to have such a strong photovoltaic industry in the first place is the so-called feed-in tariff. The federal government guarantees a fixed high price for any producer who can feed solar energy into the national grid.

These tariffs — at four times the price of a normal kilowatt, until a recent cut — make rooftop solar panels worthwhile even to private citizens, and over the last decade they've made Germany a world leader in solar-power generation.

But equipment prices have fallen so quickly that the German solar industry may not have to rely much longer on the tariffs at all. Market analyst Markus Lohr told *Manager Magazin* that photovoltaic manufacturers have started to bring production up to new economies of scale: "The companies are lowering their own costs by building massive factories," he said. "The age of feed-in tariffs is ending (in Germany), and photovoltaics are already partly competitive."

http://www.miller-mccune.com/environment/falling-cost-of-renewables-softens-nuclear-shutdown-36719/

Quantum upgrade removes need for spooky observer

- 27 October 2011 by **David Shiga**
- Magazine issue 2836.

Am I really changing anything? *(Image: Andy Ryan/Stone/Getty)*

QUANTUM mechanics - simultaneously physics's most successful and most baffling theory - may be in for an upgrade.

It faces a challenge from a modified version that would solve a largely ignored puzzle at the heart of the theory: why do subatomic particles never let us catch them in the act of being in many places at once but instead "collapse" into a single position as soon as we observe them?

Unlike most attempts at modification, this latest upgrade is generating special excitement as it meshes with another pillar of physics, Einstein's special relativity.

It also comes at the same time as a proposed test for such modifications - and a recent plea from a Nobel laureate to stop ignoring the collapse problem.

"Like many physicists, I have used quantum mechanics throughout my working life, cheerfully ignoring the deep questions about its meaning, but with a nagging feeling that this is something I ought to understand," says Steven Weinberg of the University of Texas at Austin, who recently posted a blueprint for devising such modifications online.

If the recent refinement holds true, much of the "spookiness" that still surrounds quantum theory would melt away.

When subatomic particles aren't being measured, they behave very strangely indeed, occupying many positions all at once. These superpositions are represented by a wave function, which can extend out into space. When a measurement is made, however, the wave function collapses and we only ever see the particle in a definite spot, never the blurry wave itself.

How can a particle possibly "know" when it is and isn't being watched? And why should observation change its behaviour, anyway? The majority of physicists aren't at all bothered by these unknowns, content in the knowledge that the theory has passed every single experimental test thrown at it. But a small band of rebels, including Weinberg, are very bothered indeed.

Since the 1980s they have wanted to modify quantum mechanics so that wave function collapse doesn't require an observer. Instead, they argue that collapse happens at random and is simply more likely when a measurement is made. The sticking point was that all attempts to mesh these theories with special relativity had failed.

Recently though, Daniel Bedingham, who splits his time between work in the financial industry and physics research at Imperial College London, has come up with a way to do just that. His theory has its roots in an approach called GRW, named after its 1986 inventors GianCarlo Ghirardi, Alberto Rimini and Tullio Weber.

GRW says that collapses are extremely rare for an individual particle, but that making an actual measurement on a particle forces it to interact with the measuring equipment. The particle becomes intimately linked, or entangled, with the many atoms that make up the measuring equipment.

Because these atoms are numerous, one of their wave functions is bound to collapse during the measuring process. Thanks to entanglement, that triggers the collapse of the rest - including that of the particle being measured. So the particle's wave function collapses on measurement, without needing any spooky reason for a change dependent on the observer.

In 1989, Philip Pearle of Hamilton College in Clinton, New York, finessed GRW with another theory called continuous spontaneous localisation. CSL attributes the random collapses of GRW to fluctuations in an entity that fills the universe, rather as a force field does, and varies across time and space. When physicists rewrote their equations to make CSL fit with the predictions of special relativity, they hit a speed bump. Unworkable "sharp jerks" emerged in the wave functions that would inject an infinite amount of energy into the universe, something we know wave functions don't actually do.

Bedingham's contribution is to come up with a way to make CSL relativistic, which avoids the infinities. Rather than allowing the fluctuating field to act directly on the wave functions, he introduces an intermediary field that smooths out its effects and prevents the sharp jerks.

Unlike a previous relativistic version of CSL, Bedingham's idea describes not only individual particles but also the forces between them - a must for any theory seeking to replace quantum mechanics.

Bedingham first posted it online in October 2010, following up with a clearer version in March of this year. The idea is creating excitement: Ghirardi for one is now joining forces with Bedingham to probe relativistic collapse models further.

However, quantum mechanics is so elegant that most physicists are still sceptical of modifications. That could change if deviations were to emerge in experiment, says Kurt Jacobs of the University of Massachusetts in Boston.

An experiment that could turn up such deviations is now being proposed by Stefan Nimmrichter of the University of Vienna, Austria, and colleagues.

When two wave functions meet, they can interfere with one another - cancelling out where a peak meets a trough and reinforcing each other where peaks align, like waves in water. Nimmrichter and colleagues propose examining the interference patterns produced when the waves associated with little clouds of atoms are made to interfere with each other (*Physical Review A*, DOI: 10.1103/PhysRevA.83.043621).

In contrast to existing quantum theory, both the original CSL and Bedingham's relativistic version of it predict that this interference pattern should be less pronounced or even absent for sufficiently dense clusters of atoms. This is because these entangled clusters are highly likely to undergo spontaneous collapse of their wave functions.

Carrying out this test will require clouds of atoms that are extremely cold and dense - pushing technology to its limits.

"We are working on the implementation of an experiment," says Markus Arndt, who leads the group at the University of Vienna. "But it is still too premature to define a definite time frame." Several other groups in Europe are also trying to perform the experiment.

Seeing this effect would constitute the first modification to quantum mechanics since its conception in the 1920s, Pearle says. "It will be an extraordinarily exciting occurrence."

Embrace many worlds, or shut up

A single subatomic particle is in many places at once, but whenever we look at it, the particle seems to decide on just one position. We never get to see the superposition. One way to explain such a bizarre, observation-dependent "collapse" is to modify quantum mechanics itself (see main story). But a range of interpretations can explain collapse within standard quantum mechanics.

The "many worlds" interpretation is probably the most famous of these and certainly the most mind-bending. It says that every possible position of an object is actually realised, but each in a separate universe: the act of observing causes the universe to split into two or more versions, so an observer only ever sees one position.

For those who find that a bit perplexing, there's always quantum Darwinism, where measurement causes a kind of natural selection to take place among the many possible states of an object. Certain states are better at imprinting information onto their surroundings, including measuring devices. Thus we tend to see one of these states when making a measurement.

By far the most popular approach, however, is the more prosaic "Shut up and calculate", which boils down to "It gets the right answers, so why worry about how or why".

http://www.newscientist.com/article/mg21228363.600-quantum-upgrade-removes-need-for-spooky-observer.html?full=true&print=true

Wood Pellets Energizing Europe, Timber Industry

A thriving transatlantic trade in compressed wood scraps is creating New World timber jobs and meeting Old World clean energy requirements.

By Michael Scott Moore

Until recently these wood pellets were a boring product for home stoves, but now, wood counts as a (slow) renewable energy source, and it pollutes less than coal. (Wikipedia.org)

One strange side effect of the European campaign to slash emissions by 2020 is a boom in North American timber products. A chief at one British Columbia wood-processing firm, Pinnacle Renewable Energy, made a slightly surprising remark to Germany's *Manager Magazin* this year: "We've grown to a size where we can fill whole cargo ships," said Leroy Reitsma, Pinnacle's chief operating officer, "and that makes it profitable to export wood pellets."

Wood pellets?

Until recently they were a boring product for home stoves, usually found in northern supermarkets next to the Duraflame logs. But Europe's international energy firms need more and more of them to mix into their coal-burning plants. Wood counts as a (slowly) renewable energy source, and it pollutes less than coal.

"Europe can meet its CO2 emissions goals with help from these overseas resources," said Fritz Varenholt, chief of the German-owned energy firm Innogy, which opened a pellet plant this year in the U.S. state of Georgia.

By "co-firing" coal with Innogy pellets, the German energy firm RWE expects to save about a million tons of CO2 emissions per year, Varenholt said. The pellet trend should only grow after 2020, since Germany has decided to replace part of its nuclear power capacity with coal plants.

Wood pellets are just compressed sawdust and timber waste. Both Canada and the U.S. have huge surpluses. British Columbia's forests in particular have been hit so hard by the mountain pine beetle that deadwood for pellets is abundant. Europeans can't use wood from their own forests because much of the forest is gone or protected, and European land is tight.

Canada sold a million tons of pellets to Europe last year, mostly to the Netherlands, Belgium, and Britain. Pellets, along with lumber sales to China, helped the Canadian forest industry turn an overall profit last year for the first time since 2007, when the American housing market crash caused a critical slump.

Scientists even claim pellets are cleaner than natural gas. "When only the emissions from the burning fuel are analyzed, natural gas appears to be a cleaner option," chemical and biological engineering professor Xiaotao Bi of the University of British Columbia explained to his campus' *Ingenuity* magazine. "But when you factor in the entire life cycle of natural gas … with that of engineered wood pellets, which come from a renewable resource, the pellets are a far better environmental choice. They're clean, and they're sustainable."

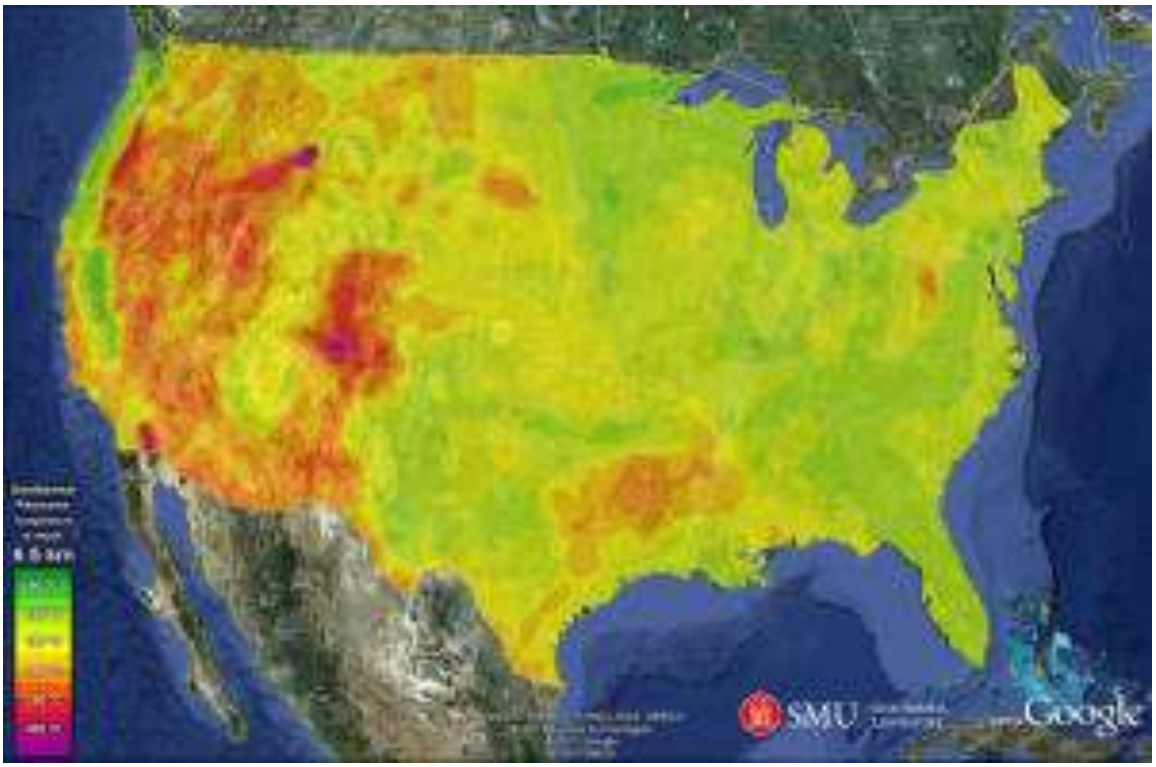
Even if you ship overseas in those champion polluters known as cargo ships?A study by researchers in Italy and Canada suggests that the long sea voyage from Vancouver to Stockholm (through the Panama Canal) accounts for 39 percent of the pellets' "total energy content" once they're burned in Europe. The "fossil fuel content" of the pellets, given such a long trip, "ranged from 19 percent to 35 percent, depending on whether natural gas or wood residue is used in the drying operation during the wood pellet production stage."

So RWE's new wood-pellet plant in Waycross, Ga., is a way to slash the shipping distance and secure a ready supply of cheap, Georgia-grown biomass. (Other German firms have already discovered the American South as a cheap place to build factories.) Innogy is also the largest "green-wood" pellet facility in the world, meaning it uses fresh wood from tree plantations, rather than timber waste.

But isn't there something wrong here? Why should it take Europeans to buy up North American wood to cut emissions from their coal? North Americans burn coal, too. But the notion of mixing it with cheap timber scraps — even old shipping pallets or Christmas trees can be "pelleted" — hasn't caught on. The difference has to do with Europe's emissions goals, which the EU may actually achieve. "Europe is like the black hole for wood pellets," said Brian Getzelman, who founded the American firm ArborPellet. "They just can't get enough of them."

http://www.miller-mccune.com/environment/wood-pellets-energizing-europe-timber-industry-36853/

Geothermal Mapping Report Confirms Vast Coast-To-Coast Clean Energy Source in U.S.



New research documents significant geothermal resources across the United States capable of producing more than three million megawatts of green power -- 10 times the installed capacity of coal power plants today. (Credit: Courtesy of SMU Geothermal Laboratory / Google Earth)

ScienceDaily (Oct. 25, 2011) — New research from SMU's Geothermal Laboratory, funded by a grant from Google.org, documents significant geothermal resources across the United States capable of producing more than three million megawatts of green power -- 10 times the installed capacity of coal power plants today.

Sophisticated mapping produced from the research, viewable via Google Earth at www.google.org/egs, demonstrates that vast reserves of this green, renewable source of power generated from Earth's heat are realistically accessible using current technology.

The results of the new research, from SMU Hamilton Professor of Geophysics David Blackwell and Geothermal Lab Coordinator Maria Richards, confirm and refine locations for resources capable of supporting large-scale commercial geothermal energy production under a wide range of geologic conditions, including significant areas in the eastern two-thirds of the United States. The estimated amounts and locations of heat stored in Earth's crust included in this study are based on nearly 35,000 data sites -- approximately twice the number used for Blackwell and Richards' 2004 Geothermal Map of North America, leading to improved detail and contouring at a regional level.

Based on the additional data, primarily drawn from oil and gas drilling, larger local variations can be seen in temperatures at depth, highlighting more detail for potential power sites than was previously evident in the eastern portion of the U.S. For example, eastern West Virginia has been identified as part of a larger Appalachian trend of higher heat flow and temperature.

Conventional U.S. geothermal production has been restricted largely to the western third of the country in geographically unique and tectonically active locations. For instance, The Geysers Field north of San Francisco is home to more than a dozen large power plants that have been tapping naturally occurring steam reservoirs to produce electricity for more than 40 years.

However, newer technologies and drilling methods can now be used to develop resources in a wider range of geologic conditions, allowing reliable production of clean energy at temperatures as low as 100˚C (212˚F) -- and in regions not previously considered suitable for geothermal energy production. Preliminary data released from the SMU study in October 2010 revealed the existence of a geothermal resource under the state of West Virginia equivalent to the state's existing (primarily coal-based) power supply.

"Once again, SMU continues its pioneering work in demonstrating the tremendous potential of geothermal resources," said Karl Gawell, executive director of the Geothermal Energy Association. "Both Google and the SMU researchers are fundamentally changing the way we look at how we can use the heat of the Earth to meet our energy needs, and by doing so are making significant contributions to enhancing our national security and environmental quality."

"This assessment of geothermal potential will only improve with time," said Blackwell. "Our study assumes that we tap only a small fraction of the available stored heat in the Earth's crust, and our capabilities to capture that heat are expected to grow substantially as we improve upon the energy conversion and exploitation factors through technological advances and improved techniques."

Blackwell is releasing a paper with details of the results of the research to the Geothermal Resources Council on October 25, 2011.

Blackwell and Richards first produced the 2004 Geothermal Map of North America using oil and gas industry data from the central U.S. Blackwell and the 2004 map played a significant role in a 2006 Future of Geothermal Energy study sponsored by the U.S. Department of Energy that concluded geothermal energy had the potential to supply a substantial portion of the future U.S. electricity needs, likely at competitive prices and with minimal environmental impact. SMU's 2004 map has been the national standard for evaluating heat flow, temperature and thermal conductivity for potential geothermal energy projects.

In this newest SMU estimate of resource potential, researchers used additional temperature data and in-depth geological analysis for the resulting heat flow maps to create the updated temperature-at-depth maps from 3.5 kilometers to 9.5 kilometers (11,500 to 31,000 feet). This update revealed that some conditions in the eastern two-thirds of the U.S. are actually hotter than some areas in the western portion of the country, an area long-recognized for heat-producing tectonic activity. In determining the potential for geothermal production, the new SMU study considers the practical considerations of drilling, and limits the analysis to the heat available in the top 6.5 km (21,500 ft.) of crust for predicting megawatts of available power. This approach incorporates a newly proposed international standard for estimating geothermal resource potential that considers added practical limitations of development, such as the inaccessibility of large urban areas and national parks. Known as the 'technical potential' value, it assumes producers tap only 14 percent of the 'theoretical potential' of stored geothermal heat in the U.S., using currently available technology.

Three recent technological developments already have sparked geothermal development in areas with little or no tectonic activity or volcanism:

1. Low Temperature Hydrothermal -- Energy is produced from areas with naturally occurring high fluid volumes at temperatures ranging from less than boiling to 150°C (300°F). This application is currently producing energy in Alaska, Oregon, Idaho and Utah.

2. Geopressure and Coproduced Fluids Geothermal -- Oil and/or natural gas are produced together with electricity generated from hot geothermal fluids drawn from the same well. Systems are installed or being installed in Wyoming, North Dakota, Utah, Louisiana, Mississippi and Texas.
3. Enhanced Geothermal Systems (EGS) -- Areas with low fluid content, but high temperatures of more than 150°C (300°F), are "enhanced" with injection of fluid and other reservoir engineering techniques. EGS resources are typically deeper than hydrothermal and represent the largest share of total geothermal resources capable of supporting larger capacity power plants.

A key goal in the SMU resource assessment was to aid in evaluating these nonconventional geothermal resources on a regional to sub-regional basis.

Areas of particular geothermal interest include the Appalachian trend (Western Pennsylvania, West Virginia, to northern Louisiana), the aquifer heated area of South Dakota, and the areas of radioactive basement granites beneath sediments such as those found in northern Illinois and northern Louisiana. The Gulf Coast continues to be outlined as a huge resource area and a promising sedimentary basin for development. The Raton Basin in southeastern Colorado possesses extremely high temperatures and is being evaluated by the State of Colorado along with an area energy company.

SMU's Geothermal Laboratory in Dedman College of Humanities and Sciences conducted this research through funding provided by Google.org, which is dedicated to using the power of information and innovation to advance breakthrough technologies in clean energy.

Story Source:

The above story is reprinted from materials provided by **Southern Methodist University**.

http://www.sciencedaily.com/releases/2011/10/111025135936.htm

More Evidence That MDMA Could Ease PTSD

Researchers advance the idea that ecstasy and other controversial drugs could help treat traumatized combat vets.

By Michael Scott Moore

Researchers think a number of currently illegal drugs, like ecstasy, could help trauma-damaged brains. (wikipedia)

British doctors want to repeat the findings of an American study that shows MDMA — the active drug in ecstasy — to be hugely helpful in treating post-traumatic stress disorder. The idea is not quite to hand combat veterans tabs of "E" for a night of clubbing, but the researchers do think a number of currently illegal drugs, like LSD or magic mushrooms, could help trauma-damaged brains.

"I feel quite strongly that many drugs with therapeutic potential have been denied to patients and researchers because of the drugs' regulation," Dr. David Nutt, a controversial psychopharmacologist in Britain, told the *Guardian* newspaper. "The drugs have been made illegal in a vain attempt to stop kids using them, but people haven't thought about the negative consequences."

U.S. researchers in South Carolina tested 20 people suffering mostly from childhood trauma, who received a combination of the drug and psychotherapy. A control group received a placebo, but 83 percent of the patients dosed with MDMA (10 of 12) were cured in two months. That compares astonishingly well with 24 percent of the control group.

"I expected it was going to be effective," said Michael Mithoefer, the South Carolina psychiatrist who announced these results in 2010. "But I didn't necessarily expect we'd find such statistical significance in that number [of people]. That was the icing on the cake."

Mithoefer ran the study with his wife, Ann. The most obvious shortcoming of their early trial is that 20 people just isn't a large sample. So the research has moved into a new trial phase. Nineteen of Mithoefer's original patients were child-abuse victims who had suffered PTSD symptoms for around 20 years; only one was a combat veteran. But those who responded to MDMA saw their symptoms vanish completely during the eight-week study. All had been diagnosed with severe PTSD, and had received more conventional treatments and drugs.

These findings add lots of meat to the bones of two Norwegian researchers, Pål-Ørjan Johansen and Teri Krebs, profiled by Miller-McCune just two years ago, who called for more investigation of what they called "exposure therapy."

"People with PTSD often avoid triggers or reminders of the trauma and feel emotionally disconnected or are unable to benefit from the support of others — likely contributing to the development and maintenance of the disorder." They told Miller-McCune's Matt Palmquist. "A goal during exposure therapy for PTSD is to recall distressing experiences while at the same time remaining grounded in the present."

Which echoes the observations of Mithoefer: "Interestingly, several people said after their session: 'I don't know why they call this ecstasy' — because it was not an ecstatic experience. They were revisiting the trauma. It was very difficult and painful work, but the ecstasy gave them the feeling they could do it."

Specifically, it reduced their fear of remembering traumatic events in therapy and facing floods of emotion. "What's most comforting is knowing now I can handle difficult feelings without being overwhelmed," said one patient, according to the *Guardian*. "I realize feeling the fear and anger is not nearly as big a deal as I thought it would be."

Mithoefer plans to repeat his own study on patients who fought in America's recent wars, to see if the results hold up for combat stress.

In Britain, David Nutt and his colleague Ben Sessa want to run a similar trial but with "lots of neuroimaging." So far researchers have made very few brain scans of people under the influence of MDMA, precisely because the drug is illegal.

But the surprising results and the recent new demand for PTSD treatment in Britain and the United States could open a new chapter in the clinical study of hallucinogens, which Western governments criminalized only after a war on drugs gained momentum in the '60s and '70s.

Nutt had headed the United Kingdom government's Advisory Council on the Misuse of Drugs, but Gordon Brown's health minister sacked him at the end of 2009 for objecting in public to stricter laws against marijuana. British law has three categories of severity for illicit drugs, which the courts use as guidelines to punish users. The government had recently re-classified pot.

"The obscenity of hunting down low-level cannabis users to protect them is beyond absurd," said Nutt, who was then labeled "the nutty professor" by some British tabloids.

Britain's home secretary, Alan Johnson, suffered a backlash after the controversy because the public tended to agree with Nutt that both cannabis and ecstasy were less harmful than cigarettes or alcohol.

http://www.miller-mccune.com/health/more-evidence-that-mdma-could-ease-ptsd-37314/

Scientists glimpse inside a Peruvian mummy

By Daniel Nasaw and Matt Danzico BBC News Magazine, Washington

Dr Bruno Frohlich says he hopes the scan can reveal secrets of the mummy's life and death

In a small room lined with shelves of skulls, fossils, bones and antique violins, researchers are using advanced computer imaging to study priceless objects, including a mummy from Peru. So what's inside?

Some patients find CT scanners and other medical imaging devices claustrophobic.

But this lady, a high-born Peruvian woman in her 40s, was not complaining - she has been dead for about seven centuries. And researchers at the Smithsonian Institution's National Museum of Natural History would like to know a bit more about her.

The nameless woman is one of the best preserved Peruvian mummies anywhere, and the CT scanner allows researchers to peer inside her without damaging her.

The CT scanner has already revealed the mummies internal organs are intact, Dr Frohlich says

The scanner uses x-rays to shoot thousands of images of the object in thin slices. Computer software then reassembles the images to create highly accurate, detailed three-dimensional models and reconstructions.

"We could probably do the same with a traditional autopsy," says Bruno Frohlich, a physical anthropologist with the museum, "but there would be nothing left for future generations and it would destroy something that should not be destroyed."

The National Museum of Natural History is one of Washington's most popular, and on a given day its public galleries teem with school children and tourists.

To reach the CT scanner lab, a visitor passes the stuffed elephants, birds, mammals and native American artefacts and takes a lift upstairs into the research wings. Next, there is a long walk through a labyrinth of dim corridors lined with drawers holding thousands of once-living specimens - a crate of whale bones here, a box full of chipmunks there.

Spacesuits and violins

The museum's newest CT scanner, worth a cool $250,000 (£155,472), was donated by global technology giant Siemens in the spring. The company has donated four to the museum since the 1990s.

The device will take images of thousands of slices of the mummy to be reassembled in 3D

"It allows us to connect the dots of history," says Kulin Hemani, a vice-president at Siemens' computed tomography division, explaining the significance of the mummies. "How these people were living, what were their habits, how did they die?"

The CT (computed tomography) scanner has proven invaluable to researchers as it allows them an increasingly high-resolution peak inside the objects and artefacts they study, without having to cut them open or destroy them.

In addition to mummies, researchers here have used CT scanners to examine priceless Stradivarius violins, marine fossils, pottery, aging Nasa spacesuits and more. The applications are innumerable, researchers say.

On Thursday, Dr Frohlich, a native of Denmark who has been with the museum since 1978, brandished a set of fossilised reptile jaws between 50 million and 100 million years old.

Heads and bodies

Because the rocky sediment lodged in cracks and crevices in the jaws has a different density than the fossilised bone, the CT scanner will allow researchers to remove the sediment digitally by isolating it from the bone in the digital images, says Dr Frohlich.

The device can help match mummy bodies to their separated and mixed-up heads, Dr Frohlich says

That offers a picture of the scrubbed fossil without the risk of harming it with physical tools, he says.

Researchers ran a Nasa spacesuit through the CT scanner in order to learn how its polymer fibres were breaking down with age, in order better to preserve it for the future, says David Hunt, another museum anthropologist.

And recently, researchers in Mongolia sent Dr Frohlich a collection of mummies - with the bodies separated from the heads and no records to match them up.

This was fine, Dr Frohlich says, because the CT scanner will allow him to reassemble the mummies by matching the bone density of each specimen.

Natural mummification

The woman mummy, discovered in Ancon, Peru, arrived in the museum's collection between 50 years and a century ago, he says.

CT scan investigation could reveal how the woman lived - and died

When she died, she was placed upright in what looks like a red dress with an elaborately crocheted fringe, sitting cross-legged. Rather than decompose, her body was mummified by the cold, dry mountain air and wind.

The process is called natural mummification, as opposed to the classic Egyptian mummification in which the body is eviscerated and treated with chemicals.

Researchers have only recently begun to investigate her, but Dr Frohlich says the CT scanner has revealed her internal organs are intact.

That will eventually enable investigators to learn about her nutrition and diet, her general level of health, whether she suffered illness, whether she had overcome disease, whether she had broken bones or other injuries, and more.

"Maybe she's pregnant," says Dr Frohlich. "Who knows?"

Such studies add to the human understanding of ancient peoples, he says.

"We should learn about our history. Why did cultures and civilisations start up and especially why did they disappear? Is it economy or is it environment? We may be able to help our own society to learn, which will help us in our decision making."

http://www.bbc.co.uk/news/magazine-15486720

Turning Cellphones Into Mobile Microscopes

Researchers across California are working to bring medical microscopes to our cellphones — and vastly improve field medicine.

By Vince Beiser

Cellscope, is, essentially, a radically miniaturized set of regular microscope lenses. (Courtesy of Daniel Fletcher)

You can use your cellphone to take pictures, get driving directions, and free imprisoned angry birds. And perhaps soon, analyze microscopic blood samples.

Three separate University of California research teams have each concocted a new technology that converts just about any handset with a decent camera into a mobile microscope. That's a development that could have a huge impact on medicine in developing countries-allowing health care workers in shantytowns and rural villages far from a hospital to diagnose malaria, HIV, and other diseases on the spot.

All three teams of UC researchers are proceeding from the same insight: Medical labs and trained doctors are scarce in poor countries, but cellphones are practically everywhere. There are more than 5 billion mobile phones in use around the world, according to the International Telecommunications Union, and almost three-quarters of them are in developing nations. "Cellphones weren't part of our vision originally, but they made our job vastly easier," says Aydogan Ozcan, a UCLA electrical engineering professor.

Ozcan, a trim 33-year-old with neatly barbered brown hair and olive skin, left his native Turkey in 2000 to study in the U.S. and now runs a research center at the university. In his small sixth-floor office (the size is compensated for by sweeping views of the Getty Center nestled in the Santa Monica Mountains), Ozcan shows me the device he developed to piggyback on all those mobile phones.

It's called LUCAS—a loose shortening of "Lensless Ultra-wide-field Cell Monitoring Array platform based on Shadow imaging." It works like this: A square plastic housing, half the size of a matchbox, clips over the phone's photo aperture. A health care worker puts a sample of blood, saliva, or other material onto a glass slide and slips it into the housing. Battery-powered LEDs attached to the device shine light through the sample. The light penetrates the semi-transparent cells and creates a pattern of "shadows" that are projected onto the phone's CMOS sensor (the silicon chip that captures an image when you take a picture). Those patterns form a holographic image of each cell. Those images can then be sent over the wireless network to health care facilities where technicians can tell whether they show healthy blood, HIV antibodies, or waterborne parasites. The technicians then send their findings back. The whole gadget fits in the palm of your hand and costs only a few dollars.

LUCAS has so many potential applications that it has garnered a fistful of awards, and funding, from sources ranging from the Gates Foundation and the National Institutes of Health, to the Department of Defense. The Pentagon is interested in using the technology for emergency battlefield medicine. Ozcan's group is also working on adapting the technology to detect impurities in water, and even for fertility testing on semen samples.

He's most excited, however, about using LUCAS to fight malaria. "Malaria kills millions of people every year," says Ozcan. "We need diagnostic tools that can be deployed on a mass scale."

Daniel Fletcher, a 39-year-old Texan with an Einsteinian corona of auburn hair who is a bioengineering professor at the University of California, Berkeley, had the same thought a few years ago. He gave the undergraduates in his optics class a project: imagine they were in a distant part of Africa, suddenly sick, and in need of a blood test. That project became the seed from which Fletcher's mobile microscope has grown.

Dubbed Cellscope, it is, essentially, a radically miniaturized set of regular microscope lenses. The lenses, about the size of a tape dispenser, clamp over the phone's camera, and hold regular microscope slides. Users focus on the cells in the sample, as with a regular microscope, and snap a picture, which can then be transmitted by email or text message. "We're just marrying the cellphone to centuries-old technology," says Fletcher.

When Sebastian Wachsmann-Hogiu, an associate professor of pathology at the University of California, Davis, read about Fletcher's device in an academic journal a couple of years ago, his first thought was, "Wow." His second was, "We could make it simpler, and cheaper."

Wachsmann-Hogiu and his colleagues rolled out their prototype early this year. Where Ozcan's devices use no lenses and Fletcher's uses small ones, Wachsmann-Hogiu's inhabits a sort of middle ground: it uses a single tiny lens. The whole apparatus consists of a round glass lens a little bigger than a pinhead, affixed over a cellphone camera's aperture with a rubber ring and tape. Software running inside the phone corrects distortions caused by the spherical lens. Cost: $10 to $30 with glass lenses, but around $1 with plastic.

Each of these micro-microscopes has strengths and weaknesses. Wachsmann-Hogiu's is the most portable, and the cheapest, but has the lowest resolution. It can "only" see objects as small as 1.5 microns; that's good enough to spot a blood disorder like anemia, but not a virus like malaria. Ozcan's and Fletcher's have greater resolution, enabling them to see a greater variety of cells. Ozcan's LUCAS, however, has the widest field of view. Conventional microscopes can only look at one tiny area of each blood sample at a time. Ozcan's system can capture images of all the cells in a much larger swath of a sample, potentially speeding the process of diagnosis. On the other hand, it can only see samples on a slide. The other two can be held up to a patient's skin or ear to look for infections.

All three devices, however, involve transmitting highly personal medical data over cell networks. That raises obvious privacy concerns; hackers could intercept that data. "It's a problem for the whole field of

telemedicine," acknowledges Ozcan. The images LUCAS captures will be encrypted, he says, but for the most part, he doesn't believe there's much of a threat from data thieves wanting to steal medical information in the rural backwaters where he expects the technology to be used. Both his and Fletcher's team are also working on software that would enable a patient to be diagnosed right on the handsets, in the field.

The biggest question for these technologies, though, is the same one facing all promising but untried products: Will they actually work in the real world?

"These devices can solve the problem of how to get an image of a blood sample in front of a trained professional," says Dr. Harry Greenspun, a telemedicine expert at the Deloitte Center for Health Solutions. "But that's only one piece of the puzzle. You also need trained people, equipment to prepare the samples, a reliable wireless network, someone to review the image, and a way to make sure the patients are correctly identified at each end. A lot of new technologies solve one issue, but it's much harder to incorporate them into the entire health care system."

Fletcher and Ozcan say their teams have had encouraging results from field tests in Africa and South America. Both are aiming to bring commercial products to market within the next few years. (Wachsmann-Hogiu eventually hopes to do the same, but he's still in the prototype stage.) The technologies could be used in rich countries, too. Cancer patients, for instance, could skip weekly trips to the hospital to have their blood checked by sending an image instead. That makes Ozcan and Fletcher competitors for grants and venture capital funding. In fact, they've both received funding from some of the same sources, including, in 2009, tying for an award from the Vodafone Americas Foundation.

Fletcher says he's glad to have company. "It won't be easy to get this technology adopted," he says. "The issue of diagnosing diseases in developing countries needs as much attention as it can get. The more, the merrier."

http://www.miller-mccune.com/health/turning-cellphones-into-mobile-microscopes-36611/

'Junk DNA' Defines Differences Between Humans and Chimps

Chimpanzee. (Credit: © Kitch Bain / Fotolia)

ScienceDaily (Oct. 25, 2011) — For years, scientists believed the vast phenotypic differences between humans and chimpanzees would be easily explained -- the two species must have significantly different genetic makeups. However, when their genomes were later sequenced, researchers were surprised to learn that the DNA sequences of human and chimpanzee genes are nearly identical. What then is responsible for the many morphological and behavioral differences between the two species?

Researchers at the Georgia Institute of Technology have now determined that the insertion and deletion of large pieces of DNA near genes are highly variable between humans and chimpanzees and may account for major differences between the two species.

The research team lead by Georgia Tech Professor of Biology John McDonald has verified that while the DNA sequence of genes between humans and chimpanzees is nearly identical, there are large genomic "gaps" in areas adjacent to genes that can affect the extent to which genes are "turned on" and "turned off." The research shows that these genomic "gaps" between the two species are predominantly due to the insertion or deletion (INDEL) of viral-like sequences called retrotransposons that are known to comprise about half of the genomes of both species. The findings are reported in the most recent issue of the online, open-access journal *Mobile DNA.*

"These genetic gaps have primarily been caused by the activity of retroviral-like transposable element sequences," said McDonald. "Transposable elements were once considered 'junk DNA' with little or no function. Now it appears that they may be one of the major reasons why we are so different from chimpanzees."

McDonald's research team, composed of graduate students Nalini Polavarapu, Gaurav Arora and Vinay Mittal, examined the genomic gaps in both species and determined that they are significantly correlated with differences in gene expression reported previously by researchers at the Max Plank Institute for Evolutionary Anthropology in Germany.

"Our findings are generally consistent with the notion that the morphological and behavioral differences between humans and chimpanzees are predominately due to differences in the regulation of genes rather than to differences in the sequence of the genes themselves," said McDonald.

The current analysis of the genetic differences between humans and chimpanzees was motivated by the group's previously published findings (2009) that the higher propensity for cancer in humans vs. chimpanzees may have been a by-product of selection for increased brain size in humans.

Story Source:

The above story is reprinted from materials provided by **Georgia Institute of Technology**.

Note: Materials may be edited for content and length. For further information, please contact the source cited above.

Journal Reference:

1. Nalini Polavarapu, Gaurav Arora, Vinay K Mittal, John F McDonald. **Characterization and potential functional significance of human-chimpanzee large INDEL variation**. *Mobile DNA*, 2011; 2: 13 DOI: 10.1186/1759-8753-2-13

http://www.sciencedaily.com/releases/2011/10/111025122615.htm

Public Feels Military's Pain But Won't Share It

A new study, released on the 10th anniversary of the start of America's longest war, highlights the widening disconnect between the nation's troops and its civilians.

By Emily Badger

While national pride in America's military is strong, a new Pew study shows that the disconnect between troops and civilians seems to be growing. (Hemera/Thinkstock Images)

Americans for generations have fretted over the relationship between the military and civilian society, over how the one institution fits within the other, how the broader population receives and perceives its soldiers. But as the U.S. approaches the 10th anniversary of the launch of the war in Afghanistan this week, this much is novel: The longest war in U.S. history is being fought by the smallest percentage of its population.

The resulting implications — which Jeff Shear touched on for Miller-McCune.com earlier this year — are unsettling. As these wars have moved off of the front page, and as the soldiers fighting them have moved into sixth and seventh deployments, is a disconnect evolving between the country's servicemen and civilians? Can the U.S. make good decisions as a country about war when so few feel personally invested? And what does it mean to welcome home a soldier when so few people really know where he or she has been?

The country plows toward this latest anniversary with retiring Navy Adm. Mike Mullen's observation about the nation's civilians ringing in the air: "I fear they do not know us."

That quote from the outgoing chairman of the Joint Chiefs of Staff to this year's graduating class at West Point prefaced a massive new study of veteran and civilian public opinion in the post-Sept. 11 era released Wednesday by the Pew Research Center. The quote also popped up repeatedly during a discussion Pew hosted Wednesday to publicize the results.

The center surveyed nearly 2,000 veterans and as many civilians about their expectations of each other, their views on who should (and has been) carrying the burden during wartime and whether these wars have been "worth it."

One of the central findings was that post-Sept. 11 veterans appear to agree with Mullen. And — more surprisingly — the public does, too.

Eighty-four percent of modern-era veterans said the general public has little or no understanding of the problems they face. Among the public, 71 percent agreed. This raises the awkward question of whether it's possible to "appreciate" service if you don't really understand it.

Several factors likely are at play. In the all-volunteer professional military, soldiers are serving longer tours and aren't as quick to return to the communities from which they came. In this sense, they become less visible to civilians. The conflicts in Iraq and Afghanistan are also distinctly unconventional, making it harder for civilians to understand not just what deployed soldiers are going through, but also literally what they're doing. Are they manning Humvees or programming drones or supervising school construction in a combat zone?

What civilians say they do know is that soldiers and their families have had to make a lot of sacrifices since 9/11 (83 percent feel this way, compared to 43 percent when the same question is asked about the American people). Among people who feel the military has made more sacrifices than the public, 26 percent described this as "unfair." But 70 percent felt the added burden was "just part of being in the military."

This attitude contrasts sharply with past moments in American history. In 1930, Congress created a War Policies Commission that was charged, among other things, with considering ways to equalize the burdens of war across the population. The commission even weighed amendments to the U.S. Constitution to make this happen. Nothing ever came of the idea.

"But how far we have come in 80 years from the time when shared sacrifice in wartime was a concept that many hoped to enshrine in the Constitution," said author Rick Atkinson, who moderated the discussion Wednesday.

This history lesson, however, poses yet another question: Is it such a bad thing to disproportionately place those burdens on the people who have volunteered to take them? Pew found overwhelming support, among veterans and civilians, for continuing the country's professional military policy. That's also another way of saying Americans don't want to go back to the draft.

Civilians hold the military in higher regard than any other institution in the country. And by even higher numbers, they say they're proud of America's soldiers — even as 45 percent of the public believes neither of these wars has been worth the cost. But then there is this interesting statistic, which gets at what may be the central disconnect between a public that is happy to thank troops for their service, and a sense of what that service really entails: 91 percent of Americans are proud of soldiers, but just 48 percent would advise someone close to them to join their ranks.

http://www.miller-mccune.com/politics/public-feels-militarys-pain-but-wont-share-it-36797/

Catch-22: Is the novel still relevant to modern soldiers?

By Virginia Brown BBC News Magazine

its 50th birthday. So how close does Catch-22 come to accurately portraying today's military?

Most people will have uttered a remark about being caught between a rock and a hard place, in a Catch-22 situation. A no-win dilemma where you're damned if you do and damned if you don't.

But fewer people will have read the 1961 novel of the same name that propelled the phrase into the English language.

Catch-22 was published 50 years ago. Written by Joseph Heller, it describes the wartime experiences of B-25 bombardier, Captain John Yossarian. Heller himself had served as a US Air Force bombardier in World War II.

He drags us through the muck and absurdity of a droll group of WWII airmen stationed on a small island off the coast of Tuscany - taking in the dark and brutal nature of war. In it hero Yossarian takes drastic measures to avoid flying an ever-increasingly required number of dangerous missions.

Catch-22 characters

- Captain John Yossarian is the protagonist and hero. He is a bombardier in the 256th Squadron of the Army Air Corps during World War II, responsible for sighting and releasing bombs. All he really wants to do is go home.
- Milo Minderbinder is the mess officer who runs a global black-market syndicate. He pursues profit unscrupulously, going so far as to bomb his own men as part of a contract.
- Major Major Major Major was born Major Major Major and is unjustly promoted to major. He is uncomfortable with his new role and lonely because it keeps him at a distance from the other men.
- Colonel Cathcart, who keeps increasing the number of missions the men have to fly to complete a tour of duty, is the bane of Yossarian's life. He's obsessed with promotion and will do anything to please his superiors.
- General Dreedle is the typical no-nonsense military man, who is exceedingly demanding of his soldiers. His arch-rival General Peckem wants to take his place in Pianosa.
- Doc Daneeka is disgruntled that he was drafted and is missing out on a lucrative medical career. "Why me?" is his attitude towards war.

The only way to avoid such deadly assignments was to plead insanity, but to do so exposed a desire to live - a core aspect of the sane.

Paul Bates, 42, understands Yossarian's plight. A lieutenant colonel with the British army's Royal Artillery regiment, he is currently working as the operations officer with the US Marine Corps in Afghanistan, he says Heller is spot-on in his depiction of this internal conflict.

"Many observers say that the character of conflict changes because of such things as technological advances. But the nature of conflict, the brutal, chaotic nature of it and the associated emotions - fear, exhilaration, anxiety, courage - remain the same.

"I see that in the book and have experienced it throughout my time in the Army. Yossarian was afraid of dying, so were many of his colleagues, and he was going to do everything in his power to try to prevent it from happening."

Yossarian, who of course was drafted into the war, takes drastic measures to avoid flying dangerous missions. These include poisoning the squadron, making up fictitious ailments to stay in hospital and moving the bomb line on the map during the "Great Big Siege of Bologna".

Lt Col Bates says other Catch-22 characters are just as recognisable.

"Others were fatalists. They say things like: 'If you're destined to be killed over Bologna, then you're going to be killed, so you might just as well go out and die like a man.' Both of these approaches are ways to deal with fear of existing in a profession where you are trained to kill and might be killed yourself.

"I've seen them both on operations along with others, like the blase demeanour of Aarfy or Havermeyer's invincibility complex. I myself am a fatalist. If it's your time, it's your time."

'Self-serving orders'

Lt Col Bates also sees similarities in frustrations surrounding the military's hierarchical organisation, which gives rise to comic, inept characters in command positions such as Cathcart, Dreedle and Peckem.

"Start Quote

Bless Joseph Heller for a guidebook for the past 50 years"

Dr Roy Heidicker

There is a quote in the book: "Some men are born mediocre, some men achieve mediocrity, and some men have mediocrity thrust upon them. With Major Major it had been all three." It sums up a character who was unjustly promoted to the rank of major, on account of his birth name.

"By virtue of their appointment alone and their position in the chain of command, they are allowed to get away with enforcing outrageous self-serving orders that those below are powerless to resist for fear of extreme military punishment," says Col Bates.

Heller wrote of the combat men in the squadron being "bullied, insulted, harassed and shoved about all day long by one after the other", unable to object to orders.

In Catch-22, for those lower down the food chain, there is nowhere to go to question methods. The same can be true today mainly because the army employs the same top-down reporting system that was in place 70 years ago, says Lt Col Bates.

"This is where the military finds itself in a Catch-22. It needs to adopt a strict hierarchical system in order to fulfil its mission. There is little time for debate in a conflict situation. And yet this system can give birth to both brilliance and toxicity."

Heller, who died in 1999, served as a bombardier in Italy during WWII

When the book was published in 1961, reviews were polarised, ranging from "the best novel in years" to "disorganised, unreadable, and crass". Views still are.

Rex Temple, a retired US Air Force senior master sergeant, says he a hard time reading Heller's comical depiction of life in the armed forces. He found it hard relating to the characters, their actions and their relationships.

"Perhaps I am a bit biased because I served 28 years in a more mature and reformed service. Even past discussions with World War II veterans did not reveal anything like that portrayed in Catch-22.

"Our current military is much more disciplined and respectful than the characters portrayed by Heller. There really is no comparison to the current tours in Afghanistan or Iraq."

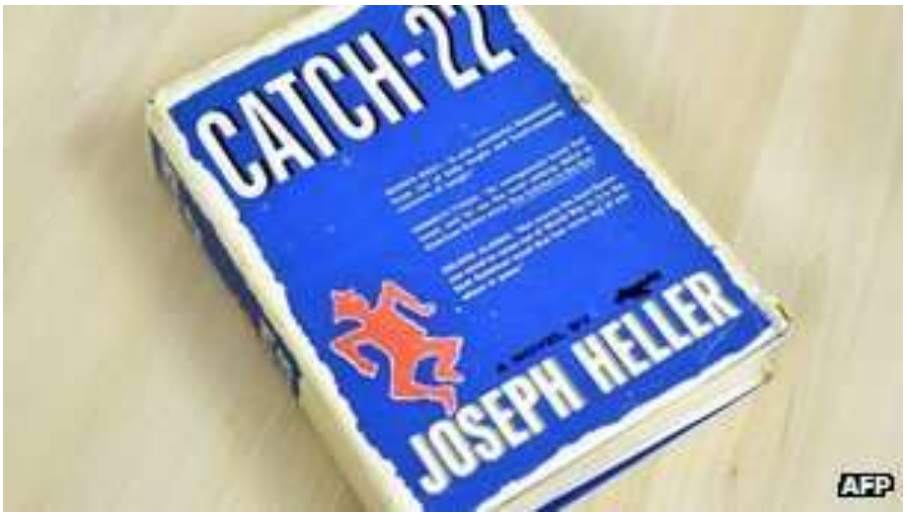
Although he did find one similarity - field mice in the tents.

Insanity and absurdity

"Except [now] an individual would be court-martialled if they used their government-issued weapons to kill rodents inside. Generally, it is forbidden to eat food inside because the falling crumbs attract insects, which attract lizards or mice," he says.

Dr Roy Heidicker, 4th Fighter wing historian based at the US Seymour Johnson Air Force Base in North Carolina, says those who serve are too busy with their duties to appreciate the irony of their circumstances.

Catch-22 facts



- More than 10 million copies sold in 21 languages
- Time magazine puts Catch-22 in the top 100 English language modern novels
- Heller started the novel in 1953 and it took him eight years to finish
- Catch-22 was adapted into a feature film in 1970, directed by Mike Nichols and starring Alan Arkin, Art Garfunkel and Martin Sheen

During his time serving in the US Marine Corps, Dr Heidicker acted as battery supply officer, just like the outrageous Milo Minderbinder - Heller's mess officer who runs an international black-market syndicate.

He pursues profit unscrupulously, but insists that "everyone has a share" in the syndicate. A classic interaction has Minderbinder looking to trick Yossarian into eating, and enjoying, chocolate-covered cotton, as he desperately tries to find a way to feed the men his latest acquisition, seeds and all.

"Milo would have been proud of me as I developed my own 'everybody wins' method of doing business," says Heidicker.

"If battalion supply didn't have it, chances were I did. I brought my system with me when I ran Regimental Special Services and had a flair for trading excess equipment for short equipment resulting in perfect inventories."

When someone writes the next great military novel, Dr Heidicker says, all insanity and absurdity will be documented through politicians, pundits and the man on the street.

"Bless Joseph Heller for a guidebook for the past 50 years. We search, hopefully not in vain, for a guidebook to help us through the next 50."

http://www.bbc.co.uk/news/magazine-15446588

Mapping the (11) Divisions in American Society

Might it be that the traits and culture of the first nonnative colonizers in North America have left an indelible mark on the local society where they settled?

By Emily Badger

Veteran journalist Colin Woodard outlines eleven regions in North America that he says illustrates that Americans do not share common traditions and visions for the country, and that these regions could continue to foster political paralysis for years to come. (Colin Woodard)

Colin Woodard suggests that we've been vastly oversimplifying things by talking about America's internal divisions between red states and blue states, between "the coasts" and the "heartland," between the urban and the rural or even the North, South, Midwest and West. Instead, the veteran journalist slices North America (sans Mexico from Tampico south) into eleven culturally distinct regions that look something like a continentally gerrymandered map gone wild.

Until more Americans grasp what this map implies, he believes, we'll continue to have a hard time forging national consensus.

Woodard floats this thesis in a new book, *American Nations: A History of the Eleven Rival Regional Cultures of North America*, that offers novel perspective on the current U.S. predicament of culture wars mixed with political paralysis mixed with economic disarray. His assessment recalls another region with complicated geography: the Balkans.

Woodard studied Eastern European history in college, and he spent the early years of his journalism career reporting from that part of the world, where centuries-old cultural fissures and historic events have left a deep mark on the present — and where those fault lines don't overlay very neatly with national borders on a map.

"In returning to America and living in other parts of the country," Woodard said this week, "it seemed clear to me these fissures exist on our continent as well. We just don't recognize them."

This idea has been broached before. Joel Garreau identified *The Nine Nations of North America* in his 1981 portrait of the country's economic and cultural divisions. And historian David Hackett Fischer proposed later that decade, in *Albion's Seed*, that four distinct British migrations had grafted parallel societies onto colonial soil.

But Woodard marries historical record with present-day observation into what he jokingly calls a "grand unified theory," tracing the evolution of early settlement patterns through the regional differences that prompted the Civil War, the civil rights movement and current political polarization.

His theory rests on the idea that there has been tremendous continuity in regional cultures from the colonial era to the new millennium. He draws on literature arguing that the first self-sustaining settlement group to arrive in an empty territory (or, in the case of much of the U.S., a territory that's been cleared of its existing inhabitants) has a dominating influence on the future evolution of that society and culture. The theory holds even when original settlers are far outnumbered by all of the people to come.

New York is a prime example. A global trading and financial center that prizes diversity and tolerance, to this day it shares many similarities with Amsterdam of 300 years ago. Dutch descendants, however, make up a fraction of 1 percent of the local population today.

These initial groups essentially laid down the cultural DNA that the rest of us who've come since have had to live to with," Woodard said. "They created the institutions and cultural assumptions and norms over pieces of geography that formed the dominant culture that future groups encountered."

(As a side note, this suggests that people who fear that the character of their communities will change dramatically with the influx of 21st century immigrants vastly overstate that threat.)

Among Woodard's other "nations," are "Yankeedom," where Calvinist roots still feed public faith in the ability of government to do good; the originally Quaker and politically moderate "Midlands"; the deeply traditional and conservative "Tidewater," settled by English gentry; and the individualistic "Greater Appalachia." Woodard's regions defy state boundaries. He groups Chicago with its northern neighbors and southern Illinois as part of Appalachia. California spans three nations: the "Left Coast," the "Far West" and Spanish-influenced "El Norte."

Of course, if these regions are defined today by the same fundamental cultural differences that divided them before the U.S. Revolution, that leads to the really unsettling proposition in Woodard's book — that "shared American values" don't really exist.

"Some people will find the notion that we don't have a shared founding story and shared values and a shared model in society going back to the beginning … upsetting or even threatening," Woodard said. "But it is in fact the case."

Americans may look back to, say, the values of the founding fathers in 1776, or talk vaguely about "freedom" and "liberty." "The problem is all of those traditional ideas and visions, those original intentions are true, but

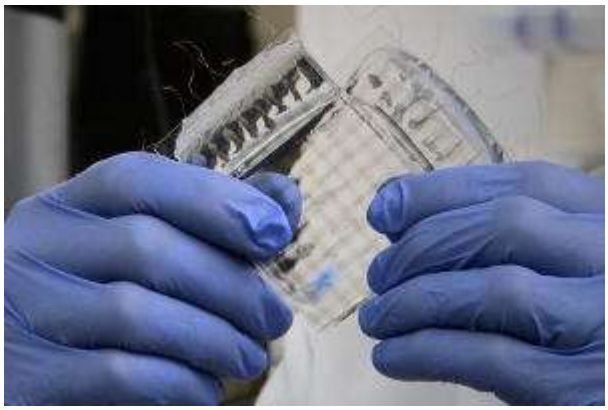
they're only true for certain regional cultures," Woodard said. "And they contradict each other. They can't all be true of the same place as fundamental models."

These divisions may also be widening. If his map is overlaid on top of Bill Bishop's thesis in ***The Big Sort***, Woodard says it looks as if Americans are not only sorting themselves into likeminded communities, but also likeminded nations, a trend that may only make consensus more elusive. Woodard doesn't offer a prescription for reconciling all these nations, but he thinks we can't have productive national policy discussions until we recognize that they exist (and surely election strategists will be the first ones to do this).

"Since many of these fundamental values and ideas of how society should be modeled are not compatible, there's no way that you can just devise a compromise where everybody's going to be happy," Woodard said. "But maybe we can devise compromise where everybody's grumbly but can live with it."

http://www.miller-mccune.com/politics/mapping-the-11-divisions-in-american-society-36920/

Researchers Build Transparent, Super-Stretchy Skin-Like Sensor



The sensor is stretchy in all directions and then rebounds to the original shape. (Credit: Steve Fyffe)

ScienceDaily (Oct. 24, 2011) — Imagine having skin so supple you could stretch it out to more than twice its normal length in any direction -- repeatedly -- yet it would always snap back completely wrinkle-free when you let go of it. You would certainly never need Botox.

That enviable elasticity is one of several new features built into a new transparent skin-like pressure sensor that is the latest sensor developed by Stanford's Zhenan Bao, associate professor of chemical engineering, in her quest to create an artificial "super skin." The sensor uses a transparent film of single-walled carbon nanotubes that act as tiny springs, enabling the sensor to accurately measure the force on it, whether it's being pulled like taffy or squeezed like a sponge.

"This sensor can register pressure ranging from a firm pinch between your thumb and forefinger to twice the pressure exerted by an elephant standing on one foot," said Darren Lipomi, a postdoctoral researcher in Bao's lab, who is part of the research team.

"None of it causes any permanent deformation," he said.

Lipomi and Michael Vosgueritchian, graduate student in chemical engineering, and Benjamin Tee, graduate student in electrical engineering, are the lead authors of a paper describing the sensor published online Oct. 23 by *Nature Nanotechnology*. Bao is a coauthor of the paper.

The sensors could be used in making touch-sensitive prosthetic limbs or robots, for various medical applications such as pressure-sensitive bandages or in touch screens on computers.

The key element of the new sensor is the transparent film of carbon "nano-springs," which is created by spraying nanotubes in a liquid suspension onto a thin layer of silicone, which is then stretched.

When the nanotubes are airbrushed onto the silicone, they tend to land in randomly oriented little clumps. When the silicone is stretched, some of the "nano-bundles" get pulled into alignment in the direction of the stretching.

When the silicone is released, it rebounds back to its original dimensions, but the nanotubes buckle and form little nanostructures that look like springs.

"After we have done this kind of pre-stretching to the nanotubes, they behave like springs and can be stretched again and again, without any permanent change in shape," Bao said.

Stretching the nanotube-coated silicone a second time, in the direction perpendicular to the first direction, causes some of the other nanotube bundles to align in the second direction. That makes the sensor completely stretchable in all directions, with total rebounding afterward.

Additionally, after the initial stretching to produce the "nano-springs," repeated stretching below the length of the initial stretch does not change the electrical conductivity significantly, Bao said. Maintaining the same conductivity in both the stretched and unstretched forms is important because the sensors detect and measure the force being applied to them through these spring-like nanostructures, which serve as electrodes.

The sensors consist of two layers of the nanotube-coated silicone, oriented so that the coatings are face-to-face, with a layer of a more easily deformed type of silicone between them.

The middle layer of silicone stores electrical charge, much like a battery. When pressure is exerted on the sensor, the middle layer of silicone compresses, which alters the amount of electrical charge it can store. That change is detected by the two films of carbon nanotubes, which act like the positive and negative terminals on a typical automobile or flashlight battery.

The change sensed by the nanotube films is what enables the sensor to transmit what it is "feeling."

Whether the sensor is being compressed or extended, the two nanofilms are brought closer together, which seems like it might make it difficult to detect which type of deformation is happening. But Lipomi said it should be possible to detect the difference by the pattern of pressure.

With compression, you would expect to see sort of a bull's-eye pattern, with the greatest deformation at the center and decreasing deformation as you go farther from the center.

"If the device was gripped by two opposing pincers and stretched, the greatest deformation would be along the straight line between the two pincers," Lipomi said. Deformation would decrease as you moved farther away from the line.

Bao's research group previously created a sensor so sensitive to pressure that it could detect pressures "well below the pressure exerted by a 20 milligram bluebottle fly carcass" that the researchers tested it with. This latest sensor is not quite that sensitive, she said, but that is because the researchers were focused on making it stretchable and transparent.

"We did not spend very much time trying to optimize the sensitivity aspect on this sensor," Bao said.

"But the previous concept can be applied here. We just need to make some modifications to the surface of the electrode so that we can have that same sensitivity."

Lipomi, Vosgueritchian and Tee contributed equally to the research and are co-primary authors of the *Nature Nanotechnology* paper. Sondra Hellstrom, a graduate student in applied physics; Jennifer Lee, an undergraduate in chemical engineering; and Courtney Fox, a graduate student in chemical engineering, also contributed to the research and are co-authors of the paper.

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Journal Reference:

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http://www.sciencedaily.com/releases/2011/10/111024101757.htm