Infoteca's E-Journal

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Public Schools: An Untapped Recreational Resource

Researchers suggest limiting liability issues to make playgrounds and other recreation areas on school grounds accessible as a cost-effective way to promote public health.

By Elisabeth Best

Making playgrounds and other recreation areas on public school grounds accessible after hours is a cost-effective way to promote public health, so say researchers, and they recommend revising state laws to explicitly protect schools from liability. (Myrrhcat / flickr.com)

There is no shortage of research touting the health benefits of physical activity: Exercise can reduce gall stones and protect the hypothalamus, in addition to providing the more obvious benefits of improved cardiovascular health and an endorphin-elevated mood.

Plenty of research has shown the consequences of inactivity, too, as John McKinney documented in a 2009 Miller-McCune.com article, pointing out that a lack of physical activity is now the No. 2 cause of death in the U.S. and accounts for 6 to 10 percent of the country's health care expenses.

One way to get people to be more physically active seems obvious: Increase the number of venues where they can work out. Researchers from UCLA argue that our neighborhoods are literally making us fat and suggest that urban planning needs to make them more livable. Jonathan Lerner agrees; his piece in the May-June issue of *Miller-McCune* magazine outlines the New Urbanism movement, which seeks to reinvent cities to promote public health.

But although evidence that Americans need more physical activity abounds, it hasn't necessarily translated into action. After all, it's a lot easier to say that a city needs a makeover to promote exercise than it is to actually renovate one.

A new study, published in the July issue of the *American Journal of Preventive Medicine*, suggests that you don't have to rebuild a community to give people more room to get active: Minor policy changes can encourage use of a largely untapped resource — public schools.

Most public schools provide space for people to get active, like playgrounds, athletic fields, outdoor tracks, outdoor basketball courts, swimming pools and indoor gymnasiums. Although many of these are funded primarily through tax dollars, liability concerns prevent schools from encouraging their use after school hours. The logic behind this is understandable: Schools don't want to deal with lawsuits from disgruntled joggers who twist their ankles on the track at night. Still, as a result of this approach, other parks and facilities must be built and maintained for general use, which can ultimately waste valuable resources.

Although public schools in all states are shielded to some degree by a form of governmental immunity, liability is still a major concern of administrators and officials. Researchers found that only 12 states currently include language that might provide limited liability protections for activities performed on school facilities, and even this legislation lacks uniformity and depth of coverage for activities likely to occur there after hours.

However, they suggest that relatively minor legislative changes in most states could encourage schools to make their property available for public use.

Lead researcher John O. Spengler, an associate professor in the Department of Tourism, Recreation and Sport Management at the University of Florida, says that while recreational user statutes in the U.S. were originally intended to open up rural and private land for public use, social values and norms have changed since their adoption. At their inception, the statutes were meant to encourage private landowners to make their property publicly available to groups like horseback riders and whitewater rafters without fear of legal retribution in the event of an accident.

Spengler believes that they should be revised to include the health promotion of communities as a stated purpose and encourage public schools to let community members use their property recreationally.

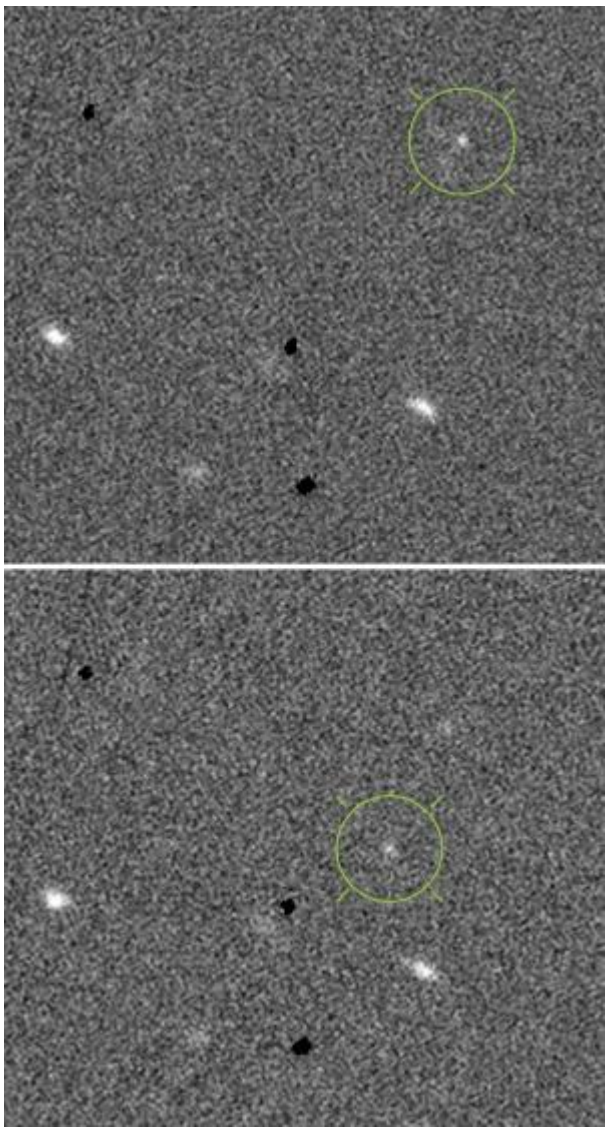
Forty-two states have recreational use statutes that could potentially protect public schools that do so; some states already reduce schools' legal responsibility for runners, joggers, playground equipment users, roller skaters, roller bladers and cyclists.

His team points out that concern over liability is a key barrier to allowing public access to school property, although they also cite insurance, safety, supervision, operations and maintenance as additional hurdles.

Still, they argue that reducing the risk schools face by opening their gates to the public could go a long way toward promoting healthy communities — and it wouldn't require rebuilding a thing.

http://www.miller-mccune.com/health/public-schools-an-untapped-recreational-resource-17714/

First Potentially Hazardous Asteroid Discovered by Pan-STARRS Telescope



Two images of 2010 ST3 (circled in green) taken by PS1 about 15 minutes apart on the night of September 16 show the asteroid moving against the background field of stars and galaxies. Each image is about 100 arc seconds across. (Credit: PS1SC)

ScienceDaily (Sep. 27, 2010) — The Panoramic Survey Telescope & Rapid Response System (Pan-STARRS) PS1 telescope has discovered an asteroid that will come within 4 million miles of Earth in mid-October. The object is about 150 feet in diameter and was discovered in images acquired on September 16, when it was about 20 million miles away.

It is the first "potentially hazardous object" (PHO) to be discovered by the Pan-STARRS survey and has been given the designation "2010 ST3."

"Although this particular object won't hit Earth in the immediate future, its discovery shows that Pan-STARRS is now the most sensitive system dedicated to discovering potentially dangerous asteroids," said Robert Jedicke, a University of Hawaii member of the PS1 Scientific Consortium, who is working on the asteroid data from the telescope. "This object was discovered when it was too far away to be detected by other asteroid surveys," Jedicke noted.

The Harvard-Smithsonian Center for Astrophysics is a major partner in the Consortium.

Most of the largest PHOs have already been catalogued, but scientists suspect that there are many more under a mile across that have not yet been discovered. These could cause devastation on a regional scale if they ever hit our planet. Such impacts are estimated to occur once every few thousand years.

Timothy Spahr, director of the Minor Planet Center (MPC), said, "I congratulate the Pan-STARRS project on this discovery. It is proof that the PS1 telescope, with its Gigapixel Camera and its sophisticated computerized system for detecting moving objects, is capable of finding potentially dangerous objects that no one else has found." The MPC, located in Cambridge, Mass., was established by the International Astronomical Union in 1947 to collect and disseminate positional measurements for asteroids and comets, to confirm their discoveries, and to give them preliminary designations.

Pan-STARRS expects to discover tens of thousands of new asteroids every year with sufficient precision to accurately calculate their orbits around the sun. Any sizable object that looks like it may come close to Earth within the next 50 years or so will be labeled "potentially hazardous" and carefully monitored. NASA experts believe that, given several years warning, it should be possible to organize a space mission to deflect any asteroid that is discovered to be on a collision course with Earth.

Pan-STARRS has broader goals as well. PS1 and its bigger brother, PS4, which will be operational later in this decade, are expected to discover a million or more asteroids in total, as well as more distant targets such as variable stars, supernovas, and mysterious bursts from galaxies across more than half the universe. PS1 became fully operational in June 2010.

The PS1 surveys have been made possible through contributions of the PS1 Science Consortium: the University of Hawaii Institute for Astronomy; the Pan-STARRS Project Office; the Max-Planck Society and its participating institutes, the Max Planck Institute for Astronomy, Heidelberg and the Max Planck Institute for Extraterrestrial Physics, Garching; the Johns Hopkins University; Durham University; the University of Edinburgh; the Queen's University Belfast; the Harvard-Smithsonian Center for Astrophysics; the Las Cumbres Observatory Global Telescope Network, Inc.; and the National Central University of Taiwan. Construction funding for Pan-STARRS (short for Panoramic Survey Telescope & Rapid Response System) has been provided by the U.S. Air Force Research Laboratory.

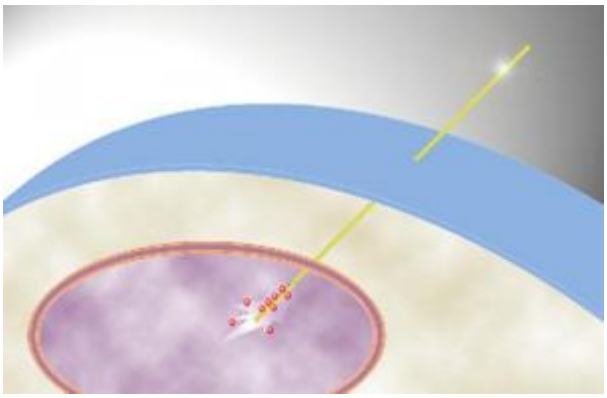
Headquartered in Cambridge, Mass., the Harvard-Smithsonian Center for Astrophysics (CfA) is a joint collaboration between the Smithsonian Astrophysical Observatory and the Harvard College Observatory. CfA scientists, organized into six research divisions, study the origin, evolution and ultimate fate of the universe.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Harvard-Smithsonian Center for Astrophysics**.

http://www.sciencedaily.com/releases/2010/09/100927162340.htm

A Shot to the Heart: Nanoneedle Delivers Quantum Dots to Cell Nucleus



University of Illinois researchers developed a nanoneedle that releases quantum dots directly into the nucleus of a living cell when a small electrical charge is applied. The quantum dots are tracked to gain information about conditions inside the nucleus. (Credit: Image courtesy Min-Feng Yu)

ScienceDaily (Sep. 28, 2010) — Getting an inside look at the center of a cell can be as easy as a needle prick, thanks to University of Illinois researchers who have developed a tiny needle to deliver a shot right to a cell's nucleus.

Understanding the processes inside the nucleus of a cell, which houses DNA and is the site for transcribing genes, could lead to greater comprehension of genetics and the factors that regulate expression. Scientists have used proteins or dyes to track activity in the nucleus, but those can be large and tend to be sensitive to light, making them hard to use with simple microscopy techniques.

Researchers have been exploring a class of nanoparticles called quantum dots, tiny specks of semiconductor material only a few molecules big that can be used to monitor microscopic processes and cellular conditions. Quantum dots offer the advantages of small size, bright fluorescence for easy tracking, and excellent stability in light.

"Lots of people rely on quantum dots to monitor biological processes and gain information about the cellular environment. But getting quantum dots into a cell for advanced applications is a problem," said professor Min-Feng Yu, a professor of mechanical science and engineering.

Getting any type of molecule into the nucleus is even trickier, because it's surrounded by an additional membrane that prevents most molecules in the cell from entering.

Yu worked with fellow mechanical science and engineering professor Ning Wang and postdoctoral researcher Kyungsuk Yum to develop a nanoneedle that also served as an electrode that could deliver quantum dots directly into the nucleus of a cell -- specifically to a pinpointed location within the nucleus. The researchers can then learn a lot about the physical conditions inside the nucleus by monitoring the quantum dots with a standard fluorescent microscope.

"This technique allows us to physically access the internal environment inside a cell," Yu said. "It's almost like a surgical tool that allows us to 'operate' inside the cell."

The group coated a single nanotube, only 50 nanometers wide, with a very thin layer of gold, creating a nanoscale electrode probe. They then loaded the needle with quantum dots. A small electrical charge releases the quantum dots from the needle. This provides a level of control not achievable by other molecular delivery methods, which involve gradual diffusion throughout the cell and into the nucleus.

"Now we can use electrical potential to control the release of the molecules attached on the probe," Yu said. "We can insert the nanoneedle in a specific location and wait for a specific point in a biologic process, and then release the quantum dots. Previous techniques cannot do that."

Because the needle is so small, it can pierce a cell with minimal disruption, while other injection techniques can be very damaging to a cell. Researchers also can use this technique to accurately deliver the quantum dots to a very specific target to study activity in certain regions of the nucleus, or potentially other cellular organelles.

"Location is very important in cellular functions," Wang said. "Using the nanoneedle approach you can get to a very specific location within the nucleus. That's a key advantage of this method." The new technique opens up new avenues for study. The team hopes to continue to refine the nanoneedle, both as an electrode and as a molecular delivery system.

They hope to explore using the needle to deliver other types of molecules as well -- DNA fragments, proteins, enzymes and others -- that could be used to study a myriad of cellular processes.

"It's an all-in-one tool," Wang said. "There are three main types of processes in the cell: chemical, electrical, and mechanical. This has all three: It's a mechanical probe, an electrode, and a chemical delivery system."

The team's findings will appear in the Oct. 4 edition of the journal *Small*. The National Institutes of Health and the National Science Foundation supported this work.

Story Source:

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

Journal Reference:

1. Kyungsuk Yum, Ning Wang, Min-Feng Yu. **Electrochemically Controlled Deconjugation and Delivery of Single Quantum Dots into the Nucleus of Living Cells**. *Small*, 2010; 6 (19): 2109 DOI: 10.1002/smll.201000855

http://www.sciencedaily.com/releases/2010/09/100927131716.htm

Complexity Not So Costly After All: Moderately Complex Plants and Animals Can Be Better Equipped to Adapt

Hummingbird and an orchid. (Credit: iStockphoto)

ScienceDaily (Sep. 27, 2010) — The more complex a plant or animal, the more difficulty it should have adapting to changes in the environment. That's been a maxim of evolutionary theory since biologist Ronald Fisher put forth the idea in 1930.

But if that tenet is true, how do you explain all the well-adapted, complex organisms -- from orchids to bower birds to humans -- in this world?

This "cost of complexity" conundrum puzzles biologists and offers ammunition to proponents of intelligent design, who hold that such intricacy could arise only through the efforts of a divine designer, not through natural selection.

A new analysis by Jianzhi "George" Zhang and coworkers at the University of Michigan and Taiwan's National Health Research Institutes reveals flaws in the models from which the cost of complexity idea arose and shows that complexity can, indeed, develop through evolutionary processes. In fact, a moderate amount of complexity best equips organisms to adapt to environmental change, the research suggests. The findings will be published online in the *Proceedings of the National Academy of Sciences.*

The study focused on a genetic phenomenon called pleiotropy, in which a single gene affects more than one trait. Examples of pleiotropy are well known in certain human diseases, and the effect also has been documented in experimental animals such as fruit flies. Biologists also recognize its importance in development, aging and many evolutionary processes. However, pleiotropy is difficult to measure, and its general patterns are poorly understood, said Zhang, a professor of ecology and evolutionary biology.

Even so, scientists have developed mathematical models of the phenomenon, based on certain assumptions, and have made predictions from the results of the models. Zhang and coworkers decided to test the assumptions against real-life observations by analyzing several large databases that catalog the effects of specific genetic mutations on traits in model organisms (yeast, roundworms and mice). Each data set included hundreds to thousands of genes and tens to hundreds of traits.

For simplicity, mathematical models of pleiotropy have assumed that all genes in an organism affect all of its traits to some extent. But Zhang's group found that most genes affect only a small number of traits, while relatively few genes affect large numbers of traits.

What's more, they found a "modular" pattern of organization, with genes and traits grouped into sets. Genes in a particular set affect a particular group of traits, but not traits in other groups.

In addition, the researchers learned that the more traits a gene affects, the stronger its effect on each trait.

All of these findings challenge the assumptions underlying the classic mathematical models that suggest complexity is prohibitively costly.

When Fisher first wrote about the cost of complexity, he argued that random mutations -- which, along with natural selection, drive evolution -- are more likely to benefit simple organisms than complex organisms.

"Think of a hammer and a microscope," Zhang said. "One is complex, one is simple. If you change the length of an arbitrary component of the system by an inch, for example, you're more likely to break the microscope than the hammer."

In a paper published in 2000, evolutionary geneticist H. Allen Orr of Rochester came up with additional reasons for the cost of complexity. According to his model, even if a mutation benefits a complex organism, it's unlikely to spread throughout the whole population and become "fixed." And even if it does that, the advantage of the mutation is likely to be small.

By incorporating a more realistic representation of pleiotropy, Zhang's analysis found the reverse of Orr's arguments to be true. Although Fisher's observation still holds, reversing Orr's assertions minimizes its impact, thus reducing the cost of complexity.

Further, the analysis showed that the ability of organisms to adapt is highest at intermediate levels of complexity. "This means a simple organism is not best, and a very complex organism is not best; some intermediate level of complexity is best in terms of the adaptation rate," Zhang said.The new findings help buffer evolutionary biology against the criticisms of intelligent design proponents, Zhang said. "The evolution of complexity is one thing that they often target. Admittedly, there were some theoretical difficulties in explaining the evolution of complexity because of the notion of the cost of complexity, but with our findings these difficulties are now removed."

Zhang's coauthors on the paper are former U-M graduate student Zhi Wang, now at Sage Bionetworks in Seattle, Wash., and Ben-Yang Liao of the National Health Research Institutes in Taiwan.

Funding was provided by the U.S. National Institutes of Health and the Taiwan National Health Research Institutes.

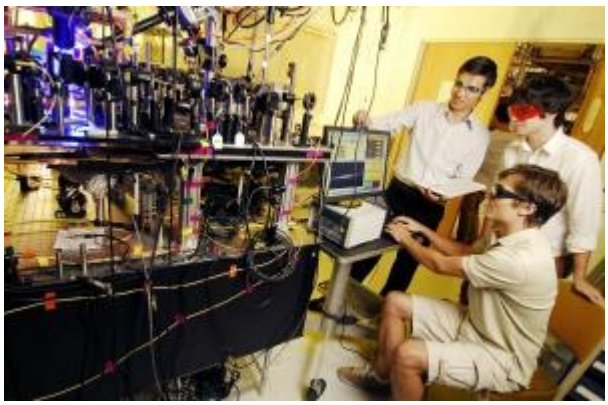
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Michigan**.

Journal Reference:

1. Zhi Wang, Ben-Yang Liao, and Jianzhi Zhang. **Genomic patterns of pleiotropy and the evolution of complexity**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1004666107

http://www.sciencedaily.com/releases/2010/09/100927155320.htm

Quantum Information Systems: Researchers Convert Signals to Telecom Wavelengths, Increase Memory Times



Researchers Alex Radnaev and Jacob Blumoff (standing) and Yaroslav Dudin collect data for a study of quantum information systems at the Georgia Institute of Technology. (Credit: Gary Meek)

ScienceDaily (Sep. 27, 2010) — Using optically dense, ultra-cold clouds of rubidium atoms, researchers have made advances in three key elements needed for quantum information systems -- including a technique for converting photons carrying quantum data to wavelengths that can be transmitted long distances on optical fiber telecom networks.

The developments move quantum information networks -- which securely encode information by entangling photons and atoms -- closer to a possible prototype system.

Researchers at the Georgia Institute of Technology reported the findings Sept. 26 in the journal *Nature Physics*, and in a manuscript submitted for publication in the journal *Physical Review Letters*. The research was sponsored by the Air Force Office of Scientific Research, the Office of Naval Research and the National Science Foundation.

The advances include:

- Development of an efficient, low-noise system for converting photons carrying quantum information at infrared wavelengths to longer wavelengths suitable for transmission on conventional telecommunications systems. The researchers have demonstrated that the system, believed to be the first of its kind, maintains the entangled information during conversion to telecom wavelengths -- and back down to the original infrared wavelengths.
- A significant improvement in the length of time that a quantum repeater -- which would be necessary to transmit the information -- can maintain the information in memory. The Georgia Tech team reported memory lasting as long as 0.1 second, 30 times longer than previously reported for systems based on cold neutral atoms and approaching the quantum memory goal of at least one second -- long enough to transmit the information to the next node in the network.
- An efficient, low-noise system able to convert photons of telecom wavelengths back to infrared wavelengths. Such a system would be necessary for detecting entangled photons transmitted by a quantum information system.

"This is the first system in which such a long memory time has been integrated with the ability to transmit at telecom wavelengths," said Brian Kennedy, a co-author of the Nature Physics paper and a professor in the Georgia Tech School of Physics. "We now have the crucial aspects needed for a quantum repeater."

The conversion technique addresses a long-standing issue facing quantum networks: the wavelengths most useful for creating quantum memory aren't the best for transmitting that information across optical telecommunications networks. Wavelengths of approximately 1.3 microns can be transmitted in optical fiber with the lowest absorption, but the ideal wavelength for storage is 795 nanometers.

The wavelength conversion takes place in a sophisticated system that uses a cloud of rubidium atoms packed closely together in gaseous form to maximize the likelihood of interaction with photons entering the samples. Two separate laser beams excite the rubidium atoms, which are held in a cigar-shaped magneto-optical trap about six millimeters long. The setup creates a four-wave mixing process that changes the wavelength of photons entering it.

"One photon of infrared light going in becomes one photon of telecom light going out," said Alex Kuzmich, an associate professor in the Georgia Tech School of Physics and another of the Nature Physics paper's co-authors. "To preserve the quantum entanglement, our conversion is done at very high efficiency and with low noise."

By changing the shape, size and density of the rubidium cloud, the researchers have been able to boost efficiency as high as 65 percent. "We learned that the efficiency of the system scales up rather quickly with the size of the trap and the number of atoms," Kuzmich said. "We spent a lot of time to make a really dense optical sample. That dramatically improved the efficiency and was a big factor in making this work."

The four-wave mixing process does not add noise to the signal, which allows the system to maintain the information encoded onto photons by the quantum memory. "There are multiple parameters that affect this process, and we had to work hard to find the optimal set," noted Alexander Radnaev, another co-author of the *Nature Physics* paper.

Once the photons are converted to telecom wavelengths, they move through optical fiber -- and loop back into the magneto-optical trap. They are then converted back to infrared wavelengths for testing to verify that the entanglement has been maintained. That second conversion turns the rubidium cloud into a photon detector that is both efficient and low in noise, Kuzmich said.

Quantum memory is created when laser light is directed into a cloud of rubidium atoms confined in an optical lattice. The energy excites the atoms, and the photons scattered from the atoms carry information about that excitation. In the new Georgia Tech system, these photons carrying quantum information are then fed into the wavelength conversion system.

The research team took two different approaches to extending the quantum memory lifetime, both of which sought to mix the two levels of atoms involved in encoding the quantum information. One approach, described in the *Nature Physics* paper, used an optical lattice and a two-photon process. The second approach, described in the *Physical Review Letters* submission, used a magnetic field approach pioneered by researchers at the National Institute of Standards and Technology.

The general purpose of quantum networking is to distribute entangled qubits -- two correlated data bits that are either "0" or "1" -- over long distances. The qubits would travel as photons across existing optical networks that are part of the existing global telecommunications system.

Because of loss in the optical fiber that makes up these networks, repeaters must be installed at regular intervals to boost the signals. For carrying qubits, these repeaters will need quantum memory to receive the photonic signal, store it briefly, and then produce another signal that will carry the data to the next node, and on to its final destination.

"This is another significant step toward improving quantum information systems based on neutral atoms," Kuzmich said. "For quantum repeaters, most of the basic steps have now been made, but achieving the final benchmarks required for an operating system will require intensive optical engineering efforts."

In addition to those already mentioned, the research team also included Y.O. Dudin, R. Zhao, H.H. Jen, J.Z. Blumoff and S.D. Jenkins.

Story Source:

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Journal Reference:

1. A. G. Radnaev, Y. O. Dudin, R. Zhao, H. H. Jen, S. D. Jenkins, A. Kuzmich & T. A. B. Kennedy. **A quantum memory with telecom-wavelength conversion**. *Nature Physics*, 2010; DOI: 10.1038/nphys1773

http://www.sciencedaily.com/releases/2010/09/100926195027.htm

Quarks 'Swing' to the Tones of Random Numbers

7	6	2	3	2	7	9	4	2
7	1	4	8	4	3	6	3	9
6	7	3	8	9	4	7	9	4
1	7	7	9	7	6	5	7	4
8	2	1	6	5	8	7	6	3
7	4	1	2	7	6	8	1	7
5	4	1	7	4	7	9	8	9
9	4	9	1	8	8	6	9	3
2	3	3	6	2	8	8	6	1

A matrix is a rectangular array of numbers. A random matrix can be compared to a Sudoku filled with random numbers. Matrices are part of the equations governing the movements of the particles. In a random matrix there are numbers that are entered randomly, while there are still certain symmetries, for example, you can require that the numbers in the lower left should be a copy of the numbers above the diagonal. This is called a symmetrical matrix. (Credit: Kim Splittorff, Associate Professor, Niels Bohr Institute, University of Copenhagen)

ScienceDaily (Sep. 27, 2010) — At the Large Hadron Collider at CERN, protons crash into each other at incredibly high energies in order to 'smash' the protons and to study the elementary particles of nature -- including quarks. Quarks are found in each proton and are bound together by forces which cause all other known forces of nature to fade. To understand the effects of these strong forces between the quarks is one of the greatest challenges in modern particle physics. New theoretical results from the Niels Bohr Institute show that enormous quantities of random numbers can describe the way in which quarks 'swing' inside the protons.

The results have been published in arXiv and will be published in the journal *Physical Review Letters.*

Just as we must subject ourselves, for example, to the laws of gravity and not just float around weightless, quarks in protons are also subject to the laws of physics. Quarks are one of the universe's smallest, known building blocks. Each proton inside the atomic nucleus is made up of three quarks and the forces between the quarks are so strong that they can never -- under normal circumstances, escape the protons

Left- and right-handed quarks

The quarks combined charges give the proton its charge. But if you add up the masses of the quarks you do not get the mass of the proton. Instead, the mass of the proton is dependent on how the quarks swing. The oscillations of the quarks are also central for a variety of physical phenomena. That is why researchers have worked for years to find a theoretical method for describing the oscillations of quarks.

The two lightest quarks, 'up' and 'down' quarks, are so light that they can be regarded as massless in practice. There are two types of such massless quarks, which might be called left-handed and right-handed. The mathematical equation governing quarks' movements show that the left-handed quarks swing independently of the right-handed. But in spite of the equation being correct, the left-handed quarks love to 'swing' with the right-handed.

Spontaneous symmetry breaking

"Even though this sounds like a contradiction, it is actually a cornerstone of theoretical physics. The phenomenon is called spontaneous symmetry breaking and it is quite easy to illustrate," explains Kim Splittorff, Associate Professor and theoretical particle physicist at the Niels Bohr Institute, and gives an example: A dance floor is filled with people dancing to rhythmic music. The male dancers represent the left-handed quarks and the female dancers the right-handed quarks. All dance without dance partners and therefore all can dance around freely. Now the DJ puts on a slow dance and the dancers pair off. Suddenly, they cannot spin around freely by themselves. The male (left-handed) and female (right-handed) dancers can only spin around in pairs by agreeing on it. We say that the symmetry 'each person swings around, independent of all others' is broken into a different symmetry 'a pair can swing around, independent of other pairs'.

Similarly for quarks, it is the simple solution that the left-handed do not swing with the right-handed. But a more stabile solution is that they hold onto each other. This is spontaneous symmetry breaking.

Dance to random tones

"Over several years it became increasingly clear that the way in which the left-handed and right-handed quarks come together can be described using a massive quantities of random numbers. These random numbers are elements in a matrix, which one may think of as a Soduko filled in at random. In technical jargon these are called Random Matrices," explains Kim Splittorff, who has developed the new theory together with Poul Henrik Damgaard, Niels Bohr International Academy and Discovery Center and Jac Verbaarschot, Stony Brook, New York.

Even though random numbers are involved, what comes out is not entirely random. You could say that the equation that determines the oscillations of the quarks give rise to a dance determined by random notes. This description of quarks has proven to be extremely useful for researchers who are looking for a precise numerical description of the quarks inside a proton.

It requires some of the most advanced supercomputers in the world to make calculations about the quarks in a proton. The central question that the supercomputers are chewing on is how closely the left-handed and right-handed quarks 'dance' together. These calculations can also show why the quarks remain inside the protons.

One problem up until now has been that these numerical descriptions have to use an approximation to the 'real' equation for the quarks. Now the three researchers have shown how to correct for this so that the quarks in the numerical calculations also 'swing' correctly to random numbers.

New understanding of the data

"Using our results we can now describe the numerical calculations from large research groups at CERN and leading universities very accurately," says Kim Splittorff.

"What is new about our work is that not only the exact equation for quarks, but also the approximation, which researchers who work numerically have to use, can be described using random matrices. It is already extremely surprising that the exact equation shows that the quarks swing by random numbers. It is even more exciting that the approximation used for the equation has a completely analogous description. Having an accurate analytical description available for the numerical simulations is a powerful tool that provides an entirely new understanding of the numerical data. In particular, we can now measure very precisely how closely the right-handed and left-handed quarks are dancing," he says about the new perspectives in the world of particle physics.

Story Source:

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

Journal Reference:

1. P.H. Damgaard, K. Splittorff, and J. Verbaarschot. **Microscopic Spectrum of the Wilson Dirac Operator**. *Physical Review Letters*, (in press) [link]

http://www.sciencedaily.com/releases/2010/09/100927105029.htm

Genetic Clues to Evolution of Jaws in Vertebrates Unearthed

Jawless lamprey fish. (Credit: Photo by Jeff Mitton)

ScienceDaily (Sep. 27, 2010) — A half-billion years ago, vertebrates lacked the ability to chew their food. They did not have jaws. Instead, their heads consisted of a flexible, fused basket of cartilage.

This week, an international team of researchers led by a faculty member from the University of Colorado at Boulder published evidence that three genes in jawless vertebrates might have been key to the development of jaws in higher vertebrates.

The finding is potentially significant in that it might help explain how vertebrates shifted from a life of passive "filter feeding" to one of active predation.

"Essentially what we found is that the genetic roots of the vertebrate jaw can be found in the embryos of a weird jawless fish called the sea lamprey," said Daniel Meulemans Medeiros, an assistant professor of ecology and evolutionary biology at CU-Boulder and lead author of the study.

Medeiros' team included Robert Cerny, assistant professor of zoology at Charles University in Prague; Maria Cattell, a researcher in the Medeiros lab; and Tatjana Sauka-Spengler, Marianne Bronner-Fraser and Feiqiao Yu from the California Institute of Technology. Their findings were published in the Sept. 22 edition of the *Proceedings of the National Academy of Sciences*.

Lampreys are eel-like fish with no jaws and a "very strange skeleton compared to their cousins" with jaws, Medeiros said. But "when we looked carefully at how genes are used during the development of the lamprey head, we saw that the basic plan for a jaw is there, and that only a few genes likely had to be moved around to create full-blown jaws."

Between jawless vertebrates -- called agnathans -- and vertebrates with jaws -- called gnathosomes -- only three genes of the 12 genes the team looked at appeared to be used differently, Medeiros said. This finding suggests that "creating a jaw in a jawless ancestor was a relatively simple matter of altering when and where these few genes are used."

The findings support a new scenario for jaw evolution, an area that has been an open question in vertebrate evolution. Viewing the eel-like fish, "It was hard to imagine how something like that could evolve into the strong, snapping, biting, chewing jaws of a shark, fish or mammal," Medeiros said.

Medeiros' work is supported by a $400,000 grant from the National Science Foundation. The Caltech researchers are supported by a $393,000 grant from the National Institutes of Health. Cerny's research stems from a grant from the Academy of Sciences in the Czech Republic.

Story Source:

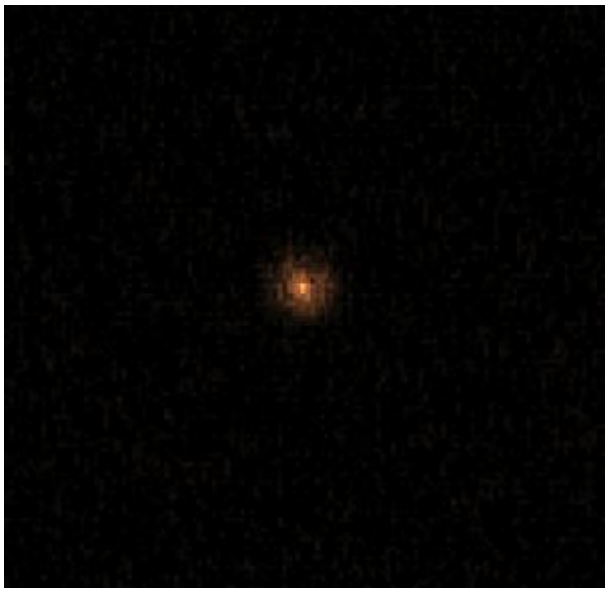
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Colorado at Boulder**.

Journal Reference:

1. R. Cerny, M. Cattell, T. Sauka-Spengler, M. Bronner-Fraser, F. Yu, D. M. Medeiros. **Evidence for the prepattern/cooption model of vertebrate jaw evolution**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1009304107

http://www.sciencedaily.com/releases/2010/09/100924095840.htm

Physics Breakthrough: Fast-Moving Neutral Atom Isolated and Captured



Physicists have developed a technique to entrap a fast-moving neutral atom – and have also seen and photographed this atom for the first time.

ScienceDaily (Sep. 27, 2010) — In a major physics breakthrough, University of Otago scientists in New Zealand have developed a technique to consistently isolate and capture a fast-moving neutral atom -- and have also seen and photographed this atom for the first time.

The entrapment of the Rubidium 85 atom is the result of a three-year research project funded by the Foundation for Research, Science and Technology, and has already prompted world-wide interest in the new science which will flow from the breakthrough.

A team of four researchers from Otago's Physics Department, led by Dr Mikkel F. Andersen, used laser cooling technology to dramatically slow a group of rubidium 85 atoms. A laser-beam, or "optical tweezers," was then deployed to isolate and hold one atom -- at which point it could be photographed through a microscope.

The researchers then proved they could reliably and consistently produce individual trapped atoms -- a major step towards using the atoms to build next-generation, ultra-fast quantum-logic computers, which harness the potency of atoms to perform complex information-processing tasks.

Dr Andersen says that unlike conventional silicon-based computers which generally perform one task at a time, quantum computers have the potential to perform numerous long and difficult calculations simultaneously; they also have the potential to break secret codes that would usually prove too complex.

"Our method provides a way to deliver those atoms needed to build this type of computer, and it is now possible to get a set of ten atoms held or trapped at the one time.

"You need a set of 30 atoms if you want to build a quantum computer that is capable of performing certain tasks better than existing computers, so this is a big step towards successfully doing that," he says.

"It has been the dream of scientists for the past century to see into the quantum world and develop technology on the smallest scale -- the atomic scale.

"What we have done moves the frontier of what scientists can do and gives us deterministic control of the smallest building blocks in our world," Dr Andersen says.

The results of the landmark study have been announced in the journal *Nature Physics*.

Dr Andersen says that within three weeks of the first laboratory experiment successfully trapping the atom, new experiments previously not thought possible were underway.

The next step is to try and generate a "state of entanglement" between the atoms, a kind of atomic romance which lasts the distance, he says.

"We need to generate communication between the atoms where they can feel each other, so when they are apart they stay entangled and don't forget each other even from a distance. This is the property that a quantum computer uses to do tasks simultaneously," says Dr Andersen.

One atom is so tiny that 10 billion side by side would make a metre in length. Atoms usually move at the speed of sound, making them difficult to manipulate.

Unlike ions, neutral atoms like the Rubidium 85 atom are notoriously difficult to pin down because they cannot be held by electrical fields. In recent times, only two other types of neutral atom have been seen and photographed by scientists in the world; the Rubidium 87 and the Caesium 133 atom.

Dr Andersen says that for him personally, the breakthrough has been a major milestone.

"I learnt at elementary school that it is impossible to see a single atom through a microscope. Well, my elementary school teacher was wrong," he says.

The other members of Dr Andersen's team are Tzahi Grünzweig, Andrew Hilliard and Matt McGovern.

Story Source:

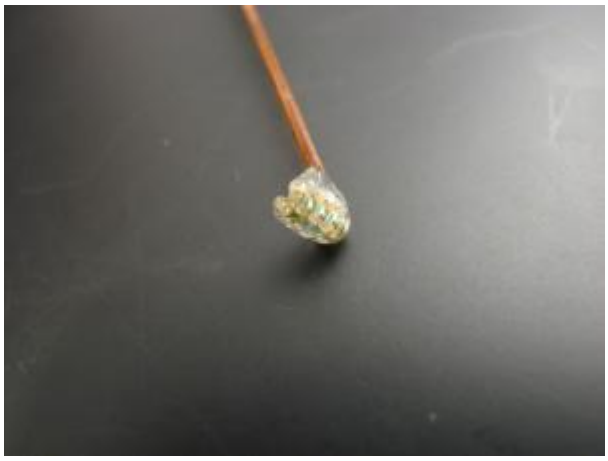
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Otago**.

Journal Reference:

1. T. Grünzweig, A. Hilliard, M. McGovern & M. F. Andersen. **Near-deterministic preparation of a single atom in an optical microtrap**. *Nature Physics*, 2010; DOI: 10.1038/nphys1778

http://www.sciencedaily.com/releases/2010/09/100927002308.htm

Light Workout: Scientists Use Optogenetics to Effectively Stimulate Muscle Movement in Mice



Closeup of the optical cuff used in the experiments. (Credit: Image courtesy of Stanford University Medical Center)

ScienceDaily (Sep. 27, 2010) — Researchers at Stanford University were able to use light to induce normal patterns of muscle contraction, in a study involving bioengineered mice whose nerve-cell surfaces are coated with special light-sensitive proteins.

The new approach allows scientists to more accurately reproduce muscle firing order, making it a valuable research tool. The investigators, from Stanford's Schools of Medicine and of Engineering, also believe this technique could someday spawn practical applications, from restoring movement to limbs paralyzed by stroke or spinal-cord or brain injury to countering spasticity caused by cerebral palsy.

The study, to be published online Sept. 26 in *Nature Medicine*, employed a technology known as optogenetics, which involves the insertion of a specialized gene derived from algae into the genomes of experimental animals. This gene encodes a light-sensitive protein that situates itself on nerve-cell surfaces. Particular wavelengths of light can trigger nerve activity in animals endowed with these proteins, modifying nerve cells' firing patterns at the experimenters' will.

"Our group's focus is on restoring optimal movement for people with physical disabilities," said one of the study's two senior authors, Scott Delp, PhD, a professor of bioengineering and the Clark Professor in the School of Engineering. "With optical stimulation, we were able to reproduce the natural firing order of motor-nerve fibers -- an important step forward."

Optogenetics was invented at Stanford by the study's other senior author, Karl Deisseroth, MD, PhD, associate professor of bioengineering and of psychiatry and behavioral science, who has used optogenetics in many experiments to conduct research on the central nervous system of freely moving animals. "This marks the first time the technique has been applied to the mammalian peripheral nervous system," Deisseroth said.

The peripheral nervous system includes the long nerve fibers that exit the spinal cord to innervate skeletal muscle, producing voluntary movement. Skeletal muscles work as aggregations of what physiologists call "motor units," each consisting of a single nerve fiber plus the muscle fibers it innervates. At various points along the motor nerve, individual fibers exit the nerve to make contact with a variable number of skeletal-muscle fibers.

Motor units come in a variety of sizes. Small ones have single, thin nerve fibers that innervate several muscle fibers, whereas the lone, thicker nerve fiber in a larger motor unit may innervate several thousand of them. Normally, when motion is initiated, it takes stronger stimulation to "fire" thick nerve fibers than thin ones. Thus, the smaller, so-called "slow-twitch" muscle fibers start contracting before larger "fast-twitch" fibers.

Fast-twitch fibers are essential for powerful athletic motions such as running, but fatigue quickly as they burn through finite stores of their primary fuel, glycogen. Their more diminutive slow-twitch counterparts, which burn their fuel slowly, are crucial to delicate movements such as those involved in sewing or drawing, as well as for fine-tuning coarser, more powerful movements. Activities relying mainly on small slow-twitch fibers can proceed for long periods of time, while larger but more-fatigable fast-twitch fibers are reserved for brief bursts of high-powered activity.

Previous attempts to restore lost motor function using programmed sequences of electrical impulses, delivered via a cuff placed around a nerve, have enabled paralyzed people to walk, if only for a few minutes. Unfortunately, large nerve fibers are more responsive than smaller ones to electrical stimulation, so muscles contract in the wrong order -- large, fast-twitch fibers first, then small, slow-twitch ones; this results in jerky motion and, soon thereafter, fatigue.

For the *Nature Medicine* study, lead author Michael Llewellyn, PhD, of Delp's lab, fashioned an "optical cuff" lined with tiny, inward-facing light-emitting diodes, which could be placed around the bioengineered animals' sciatic nerves. The LEDs emitted blue light at intensities high enough to penetrate deep into the nerve, ensuring that all of its constituent nerve fibers would receive adequate stimulation from brief impulses of light from the LEDs. The investigators then showed that optical stimulation reproduced the proper firing order of muscle fibers, inducing contractions similar to those that take place under normal conditions.

Next, using various measures, the researchers compared optically induced muscle contractions with those induced by the electrical cuff. Small, slow-twitch muscle fibers were activated at the lowest levels of optical stimulation. But with electrical stimulation, bigger fibers were triggered first. What's more, optically triggered contractions were sustained far longer than those produced by electrical stimulation.

"With optical stimulation, the muscles retained about one-third of their initial maximum force after 20 minutes, and remained at that plateau for quite a while afterward," said Llewellyn, who is now finishing his work on an MD at Stanford. "Electrical stimulation completely exhausted the same muscles within four minutes." Consistent with this, optical stimulation initiated contractions much more easily in muscles composed of predominantly slow-twitch fibers than in muscles richer in fast-twitch fibers. Electrical stimulation, in contrast, induced contractions equally in both muscle types.

The approach is, for now, primarily a research tool, Delp said. But it holds promise for clinical applications in the longer term if a way can be found to safely introduce genes coding for light-sensitive nerve-cell-surface proteins into people, he said. Just as techniques now use electrical cuffs to get paraplegics to walk for a few minutes, optical cuffs could be inserted microsurgically at appropriate places along motor nerve bundles, so that computer algorithm-controlled light impulses could induce firing in different fibers at different times, mimicking natural physiology.

Delp and Deisseroth are conducting similar research with a different protein that, in response to light, inhibits nerve fibers instead of triggering impulses in them, in the hope of someday being able to control spasticity, as for example occurs in cerebral palsy.

The study's other co-author is Kimberly Thomson, PhD, a postdoctoral scholar in Deisseroth's laboratory. The study drew funding from the National Institutes of Health and Bio-X, an interdisciplinary consortium at Stanford.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Stanford University Medical Center**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Michael E Llewellyn, Kimberly R Thompson, Karl Deisseroth & Scott L Delp. **Orderly recruitment of motor units under optical control in vivo**. *Nature Medicine*, 2010; DOI: 10.1038/nm.2228

http://www.sciencedaily.com/releases/2010/09/100926195020.htm

Pinpointing Where Volcanic Eruptions Could Strike

Erta Ale volcano in Afar region of northern Ethiopia. (Credit: iStockphoto/Rainer Albiez)

ScienceDaily (Sep. 27, 2010) — A better way to pinpoint where volcanic eruptions are likely to occur has been produced by an international team of geophysicists.

Scientists from the universities of Leeds, Purdue, Indiana and Addis Ababa, investigated volcanic activity occurring in the remote Afar desert of Northern Ethiopia between 2005 and 2009.

By studying a rare sequence of 13 magmatic events -- where hot molten rock was intruded into a crack between the African and Arabian plates -- they found that the location of each intrusion was not random. They showed that they were linked because each event changed the amount of tension in the earth's crust.

The findings, published in *Nature Geoscience*, will help scientists to more accurately predict where volcanic eruptions could strike and contribute to efforts to limit the damage they can cause.

Lead author Dr Ian Hamling, who completed the analysis as part of his PhD in the School of Earth and Environment at the University of Leeds said: "It's been known for some time that a large earthquake has a role to play in triggering subsequent earthquakes, but until now, our knowledge of volcanic events has been based on isolated cases. We have demonstrated that volcanic eruptions can influence each other. This will help us predict where future volcanic eruptions are likely to happen."

The team studied the region around a large volcanic dyke -- a vertical crack which is created when Magma seeps from underground through rifts in the surface of the earth -- which erupted in the Afar desert in September 2005.

he Magma -- hot molten rock -- was injected along the dyke between depths of 2 and 9 km, and altered the tension of the earth. The team was able to watch the 12 smaller dykes that subsequently took place in the same region over a four year period.

By monitoring levels of tension in the ground near where each dyke was intruded they found that subsequent eruptions were more likely in places where the tension increases.

Dr Hamling said: "If you look at this year's eruptions at Ejafjallajokull in Iceland, by estimating the tension in the crust at other volcanoes nearby, you could estimate whether the likelihood of them eruption has increased or decreased. Knowing the state of stress in this way won't tell you when an eruption will happen, but it will give a better idea of where it is most likely to occur."

Story Source:

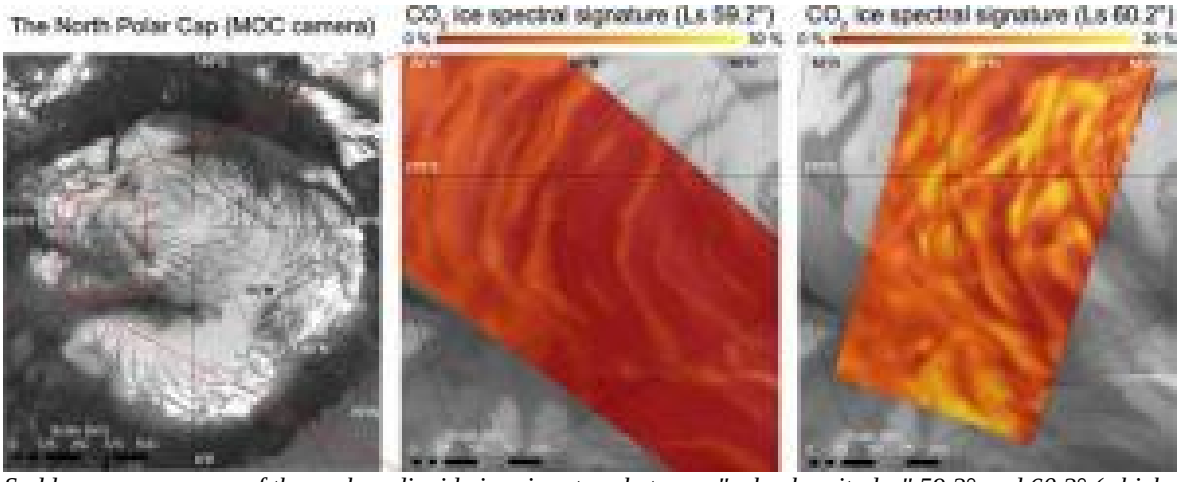
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Leeds**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Ian J. Hamling, Tim J. Wright, Eric Calais, Laura Bennati & Elias Lewi. **Stress transfer between thirteen successive dyke intrusions in Ethiopia**. *Nature Geoscience*, 2010; DOI: 10.1038/ngeo967

http://www.sciencedaily.com/releases/2010/09/100926195032.htm

Mystery of Disappearing Martian Carbon Dioxide Ice Solved?



Sudden reappearance of the carbon dioxide ice signature between "solar longitudes" 59.2° and 60.2° (which corresponds to a time lapse of approximately two Martian days) in the spiral troughs structure of the North polar cap. (Credit: Image courtesy of Europlanet Media Centre)

ScienceDaily (Sep. 27, 2010) — Scientists may have solved the mystery of the carbon dioxide ice disappearance early in the Northern Martian springs followed later by its sudden reappearance, revealing a very active water cycle on the planet. Dr. Bernard Schmitt and Mr. Thomas Appéré are reporting their results about water ice mobility during Martian Year 28, at the European Planetary Science Congress in Rome.

Seasonal ice deposits are one of the most important Martian meteorological processes, playing a major role in the water cycle of the planet. Every Martian year, alternatively during northern and southern winter, a significant part of the atmosphere condenses on the surface in the form of frost and snow. These seasonal ice deposits, which can be up to one meter thick, are mainly composed of carbon dioxide with minor amounts of water and dust. During spring, the deposits sublimate (vaporize), becoming a substantial source of water vapour, in particular in the northern hemisphere of the planet.

Dr. Schmitt and his colleagues Thomas Appéré and Dr. Sylvain Douté at the Laboratoire de Planétologie de Grenoble, France, have analyzed data taken with the OMEGA instrument on board Mars Express, for two northern Martian regions. Before the Mars Express mission (ESA), the evolution of the seasonal deposits has been monitored by the albedo (reflectivity) and temperature changes of the surface, as the ice deposits appear much brighter and are colder than the surrounding defrosted terrains."But we couldn't resolve their exact composition and how they were distributed on the planet. Near-infrared observations, such as the OMEGA data, are much better for detecting strong signatures of water and carbon dioxide ice," says Mr Appéré.

The first Martian region that the scientists observed is located on Gemina Lingula, a Northern plateau, where peculiar evolution of the carbon dioxide ice deposits was observed. "During spring the ice signature disappeared from our data, but the surface temperature was still cold enough to sustain plenty of CO_2 ice. We concluded that a thick layer of something else, either dust or water ice was overlaid. If it was dust then it would also hide water ice and the surface of the planet would become darker. None of these happened so we concluded that a layer of water ice was hiding the CO_2 ice. We had to wait until the weather gets warm enough on Mars for the water to vaporize as well, and then the carbon dioxide signatures re-appeared in our data," explains Dr Schmitt.

But where does this layer of water ice come from? Soon after spring sunrise, the solar radiation hitting the surface of Mars warms enough the CO_2 ice lying on the top layer to cause it to vaporize. But the water ice needs higher temperatures to sublimate, so a fine grained layer of water ice gradually forms hiding the carbon dioxide ice still lying beneath it. "A layer only 2 tenths of a millimetre thick is enough to completely hide the CO_2 ice. Also some water that has been vaporized at lower, warmer, Martian latitudes condenses as it moves northward and may be cold trapped on top of the CO_2 ice," says Mr. Appéré.

The second region analysed by the team is located in the spiral troughs structure of the North permanent cap. A similar situation was observed but the carbon dioxide ice re-appeard very quickly here after its initial disappearance. "This hide-and-seek game didn't make much sense to us. It wasn't cold enough for CO_2 ice to condense again, neither warm enough for water ice to sublimate," explains Dr. Schmitt. "We concluded that somehow the water ice layer was removed. The topography of the North permanent Martian cap is well-suited to entail the formation of strong katabatic (downhill) winds. Aymeric Spiga used a model from the Laboratoire de Météorologie Dynamique du CNRS to simulate those winds and he indeed confirmed the sudden re-appearances of CO_2 ice where strong katabatic winds blow," says Mr. Appéré.

Dr. Schmitt concludes: "To decipher the present and past water cycles on Mars and improve our weather models on the planet one needs to have a good understanding of the seasonal ice deposits dynamics, how they change in space and time. We are confident that our results will make a significant contribution in this direction."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Europlanet Media Centre**, via AlphaGalileo.

http://www.sciencedaily.com/releases/2010/09/100922124546.htm

Wider Statin Use Could Be Cost-Effective Preventive Measure, Study Finds

ScienceDaily (Sep. 27, 2010) — A new analysis suggests that broader statin use among adult patients may be a cost-effective way to prevent heart attack and stroke. The Stanford University School of Medicine study also found that using a popular test -- a screening for high sensitivity C-reactive protein, or CRP -- to identify patients who may benefit from statin therapy would be cost-effective, but only under certain scenarios."If statins are really as safe and effective as they appear to be, broadening the indications for statin therapy would be an effective and cost-effective strategy," said Mark Hlatky, MD, professor of health research and policy and of cardiovascular medicine. "But under different assumptions, targeted CRP screening would be a reasonable approach," Hlatky is the senior author of the findings, published online Sept. 27 in *Circulation: Journal of the American Heart Association*.

The study comes almost two years after a major clinical trial, known as the JUPITER study, showed that millions more people could benefit from taking statins, even if they have low cholesterol. That study involved patients with low cholesterol levels but elevated levels of CRP, which indicates inflammation in the body and suggests a greater risk of heart attack and stroke.

Under current clinical guidelines, statin therapy is recommended for individuals at high risk: those identified as having a 20 percent or more risk of some sort of cardiovascular event in the next 10 years. But heart attacks and stroke also occur in many people at lower risk levels, and the findings from the JUPITER study suggested that measuring CRP levels might identify patients who would benefit from statin therapy.Still, that research did not address whether it would be cost-effective to do more screening and/or to give more people statin therapy. Accordingly, Hlatky and his colleagues sought to compare the cost-effectiveness of different strategies to prevent heart disease.

For their study, the researchers developed a model to analyze the cost-effectiveness of three approaches: following current guidelines; doing CRP screening in individuals who don't meet the current guidelines for treatment, with statin therapy for those with elevated CRP levels; and providing statin therapy based on an individual's cardiovascular risk alone, without CRP testing. Their model followed hypothetical patients, starting at 40 years of age, with normal lipid levels and no clinical evidence of heart disease or diabetes.

The researchers then looked at which approaches met the threshold of costing no more than $50,000 per quality-adjusted-life-year, a common metric that takes into account quality of life as well as length of survival. (Therapies costing around $50,000 or less per quality-adjusted life-year are generally considered cost-effective.)Their conclusion? Assigning statin therapy based on risk alone, without CRP testing, was the most cost-effective strategy. The optimal strategy for men with no risk factors, for example, would be to start a statin at the age of 55.

"Initiation of statin treatment at lower risk levels without CRP testing would further improve clinical outcomes at acceptable cost, making it the optimally cost-effective strategy in our analysis," the researchers wrote in their paper.

The researchers found, however, that the optimal strategy for prevention changed if the assumptions in the model were altered. For instance, if patients with normal CRP levels get little or no benefit from statin therapy, CRP screening would be the optimal strategy. And if harms from statin use are only slightly greater than currently thought, statin therapy would not be reasonable in low-risk individuals, and following current clinical guidelines would be the most cost-effective strategy.

Clearly, there are a lot of unknowns and assumptions -- all of which tempered the researchers' conclusion. "This is not a slam-dunk decision in terms of: You should take people at low risk and put them all on treatment," said Hlatky. "If you run the model and change the assumptions even a little bit, you get a different answer. Our model shows that we need better data to be confident about the best approach to drug treatment of lower-risk individuals."For co-author Douglas Owens, MD, the study points to a high priority for determining whether statins work as well in low-risk people (i.e. those with normal CRP levels) or just high-risk ones. "That's a big uncertainty," he said, and the answer would inform how cost-effective both screening and broad therapy are.

The researchers also said it would be important to know whether high CRP levels do more than identify people who are at risk of developing heart disease, but also identify which people are more likely to have lower risk of heart attack or stroke when treated with a statin. (The test could then spare certain patients from unnecessary treatment.)

"Ideally, a marker would tell us who will benefit from drug treatment and who will not," said Hlatky. "If a test could give us that information, it would be very cost-effective. But there's not good evidence yet that CRP, or any other test, works that well."

Hlatky said a National Heart, Lung, and Blood Institute working group is now updating the clinical guidelines for statin therapy, and he hopes this research will inform their recommendations. "Maybe the threshold for statin treatment ought to be lower than is currently recommended," he said.

In the meantime, the researchers have developed an interactive tool that physicians can reference to determine the most cost-effective approach to statin therapy for individual patients. The calculator can be found at http://med.stanford.edu/hsr/crp-screening/.

Keane Lee, MD, who did the work at Stanford and is now with Kaiser Permanente of Northern California, is the lead author of the paper. Stanford co-authors include graduate student Lauren Cipriano and Owens, an investigator at the Veterans Affairs Palo Alto Health Care System and professor of medicine and of health research and policy at the medical school.

Funding for the study came from an American Heart Association-Pharmaceutical Roundtable Outcomes Research Award, the National Institutes of Health and the Social Science and Humanities Research Council of Canada. More information about the Departments of Health Research and Policy and of Medicine, which also supported the research, is available at http://hrp.stanford.edu/ and http://medicine.stanford.edu.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Stanford University Medical Center**. The original article was written by Michelle Brandt.

Journal Reference:

1. Keane K. Lee, Lauren E. Cipriano, Douglas K. Owens, Alan S. Go, Mark A. Hlatky. **Cost-Effectiveness of Using High-Sensitivity C-Reactive Protein to Identify Intermediate- and Low-Cardiovascular-Risk Individuals for Statin Therapy**. *Circulation*, 2010; DOI: 10.1161/CIRCULATIONAHA.110.947960

http://www.sciencedaily.com/releases/2010/09/100927162342.htm

Urban Gardeners Beware: There May Be Lead in Your Soil and Food

Map of lead in soil in Indianapolis shows lead levels that should be of concern to urban gardeners. (Credit: Gabriel Filippelli, Ph.D., professor of earth sciences at the School of Science at Indiana University-Purdue University Indianapolis)

ScienceDaily (Sep. 27, 2010) — Not since victory gardens helped World War II era Americans on the home front survive food shortages have urban gardens been as necessary and popular as they are today. With more food production in cities, the safety of the produce grown there becomes increasingly important.

As city dwellers across the country are harvesting fruits and vegetables for family consumption and planning ahead for the next planting season, geochemist Gabriel Filippelli, Ph.D., professor of earth sciences at the School of Science at Indiana University-Purdue University Indianapolis, warns that urban soil may be contaminated with lead. He advises investigating the legacy of contamination in soil before planting and eating.

"Most surface contamination in urban settings like Baltimore, Brooklyn, Detroit or Indianapolis is from harmful metals, especially lead, and tends to be found near roadways, older homes or lead smelters. Sources of contamination can be automobile exhaust, degraded paint, tire and vehicle debris, industrial emissions or other products of human technology," said Filippelli, who is an international leader in the emerging field of medical geology.

He encourages urban gardeners to study a map of their metropolitan area and determine potential soil contamination risk by proximity to busy streets, major roadways, freeways, dilapidated painted structures or older industrial facilities.

Gardens with no or low levels of lead contamination as determined by location or with test results of less than 200 parts per million (ppm) can be abundantly planted, but may benefit from high phosphate fertilizer which immobilizes metals like lead.

For gardens at medium risk based on location or soil tested at 200-500 ppm, he recommends covering the soil, planting in raised bed settings, and mulching between beds to reduce the risks of tracking lead-rich soil onto the plots or into the home.

For gardens at high lead risk or found to have lead levels of over 500 ppm, he counsels proceeding with caution as contamination could be coming from the soil below and the air above. While taller fruit plants are probably safe to consume, root vegetables and leafy greens like lettuce and kale are not, mainly because of the difficulties of cleaning this produce thoroughly before consumption. In this setting, raised-bed planting is critical, as is ensuring mulch or ground cover between beds and extending for 10 feet around the perimeter of the garden.

The produce of all urban gardens, even those at low risk of contamination, should be washed carefully.

"Urban gardens are powerful tools for personal health and for neighborhood revitalization. These plots should be encouraged but need to be tended with special care to ensure that lead does not adhere to the food children and adults are consuming," said Filippelli.

This season, Filippelli and School of Science students are analyzing lead levels in multiple soil samples from an initial 25 urban gardens. They hope to acquire funding to test many more urban plots beginning this autumn to inform urban dwellers, policy makers and researchers.

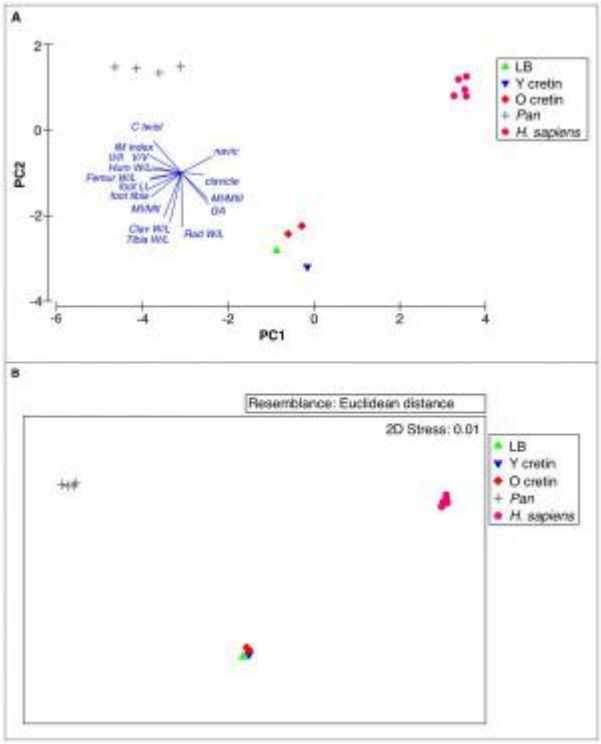
"Environmental awareness can ensure that a garden is a healthy place to work and that food is safe to eat and share," said Filippelli who has studied lead contamination in urban soil for almost a decade.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Indiana University School of Medicine**, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/09/100927131714.htm

'Hobbit' Was an Iodine-Deficient Human, Not Another Species, New Study Suggests



Multivariate analyses of quantitative features of Homo floresiensis in relation to cretins, unaffected humans and chimpanzees. Individuals are represented for each specimen by the coloured symbols above: H. floresiensis (LB), young adult cretins (Y cretin), older cretins (O cretin), H. sapiens, and P. troglodytes (Pan). Vectors are shown for each variable analyzed in the study. The direction of each vector indicates the association with each axis and the length indicates the strength of the association. (Credit: Charles Oxnard, Peter J. Obendorf, Ben J. Kefford. Post-Cranial Skeletons of Hypothyroid Cretins Show a Similar Anatomical Mosaic as Homo floresiensis. PLoS ONE, 2010; 5 (9): e13018 DOI: 10.1371/journal.pone.0013018)

ScienceDaily (Sep. 28, 2010) — A new paper is set to re-ignite debate over the origins of so-called *Homo floresiensis* -- the 'hobbit' that some scientists have claimed as a new species of human.

The University of Western Australia's Emeritus Professor Charles Oxnard and his colleagues, in a paper in *PLoS ONE* have reconfirmed, on the post-cranial skeleton, their original finding on the skull that *Homo floresiensis* in fact bears the hallmarks of humans -- *Homo sapiens* -- affected by hypothyroid cretinism.

The remains, allegedly as recent as 15,000 years, were discovered in 2003 in the Liang Bua caves on the Indonesian island of Flores by archaeologists seeking evidence of the first human migration from Asia to Australia.

When Professor Oxnard and fellow Australian researchers suggested in a 2008 paper that the skull showed evidence of endemic dwarf cretinism resulting from congenital hypothyroidism and were not a new species of human, their claim caused controversy.

In order to test their thesis, in their new paper Professor Oxnard and his team summarised data on the rest of the skeleton and mathematically compared the bones of cretins in relation to chimpanzees, unaffected humans and *H. floresiensis.* They used two methods with different statistical bases: principal components analyses (PCA) and non-metric multi-dimensional scaling (MDS).

Their work confirms the close grouping of *H. floresiensis* with the hypothyroid cretins, and the clear separation from both modern humans and from chimpanzees. This leads them to conclude that the Liang Bua remains were indeed most likely cretins from a population of unaffected *H. sapiens*. They have, further, provided a series of predictions for the further testing of the cretin hypothesis.

"This is consistent with recent hypothyroid endemic cretinism throughout Indonesia, including the nearby island of Bali," Professor Oxnard said.

"Cretinism is caused by various environmental factors including iodine deficiency -- a deficiency which would have been present on Flores at the period to which the dwarfed Flores fossils are dated."

Professor Oxnard has received the Charles R. Darwin Award for Lifetime Achievement in Physical Anthropology; was honoured as the dedicatee on a book *Shaping Primate Evolution*, Cambridge University Press; and was awarded the Chancellor's Medal of The University of Western Australia.

His co-authors in his most recent paper are Professor Peter Obendorf, School of Applied Sciences, RMIT University, Melbourne; and Professor Ben Kefford, Centre for Environmental Sustainability, Department of Environmental Sciences, University of Technology Sydney.

Story Source:

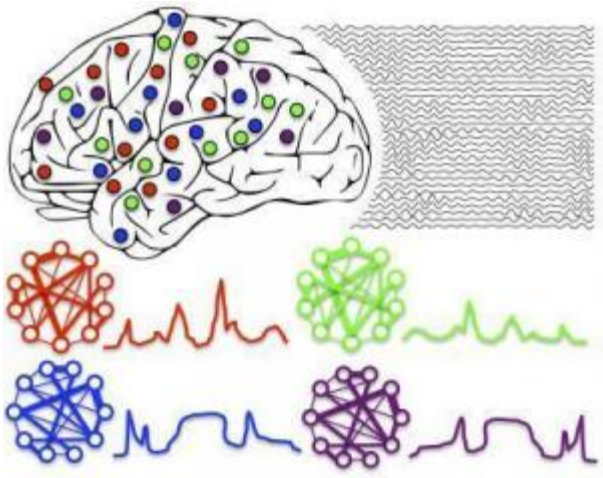
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Western Australia**.

Journal Reference:

1. Charles Oxnard, Peter J. Obendorf, Ben J. Kefford. **Post-Cranial Skeletons of Hypothyroid Cretins Show a Similar Anatomical Mosaic as Homo floresiensis**. *PLoS ONE*, 2010; 5 (9): e13018 DOI: 10.1371/journal.pone.0013018

http://www.sciencedaily.com/releases/2010/09/100928025514.htm

For Neurons to Work as a Team, It Helps to Have a Beat



This is an illustration of how brain rhythms organize distributed groups of neurons into functional cell assemblies. The colors represent different cell assemblies. Neurons in widely separated brain areas often need to work together without interfering with other, spatially overlapping groups. Each assembly is sensitive to different frequencies, producing independent patterns of coordinated neural activity, depicted as color traces to the right of each network. (Credit: Ryan Canolty, UC Berkeley)

ScienceDaily (Sep. 20, 2010) — When it comes to conducting complex tasks, it turns out that the brain needs rhythm, according to researchers at the University of California, Berkeley.

Specifically, cortical rhythms, or oscillations, can effectively rally groups of neurons in widely dispersed regions of the brain to engage in coordinated activity, much like a conductor will summon up various sections of an orchestra in a symphony.

Even the simple act of catching a ball necessitates an impressive coordination of multiple groups of neurons to perceive the object, judge its speed and trajectory, decide when it's time to catch it and then direct the muscles in the body to grasp it before it whizzes by or drops to the ground.

Until now, neuroscientists had not fully understood how these neuron groups in widely dispersed regions of the brain first get linked together so they can work in concert for such complex tasks.

The UC Berkeley findings are being published in the online early edition of the journal *Proceedings of the National Academy of Sciences*.

"One of the key problems in neuroscience right now is how you go from billions of diverse and independent neurons, on the one hand, to a unified brain able to act and survive in a complex world, on the other," said principal investigator Jose Carmena, UC Berkeley assistant professor at the Department of Electrical Engineering and Computer Sciences, the Program in Cognitive Science, and the Helen Wills Neuroscience Institute. "Evidence from this study supports the idea that neuronal oscillations are a critical mechanism for organizing the activity of individual neurons into larger functional groups."

The idea behind anatomically dispersed but functionally related groups of neurons is credited to neuroscientist Donald Hebb, who put forward the concept in his 1949 book "The Organization of Behavior."

"Hebb basically said that single neurons weren't the most important unit of brain operation, and that it's really the cell assembly that matters," said study lead author Ryan Canolty, a UC Berkeley postdoctoral fellow in the Carmena lab.

It took decades after Hebb's book for scientists to start unraveling how groups of neurons dynamically assemble. Not only do neuron groups need to work together for the task of perception -- such as following the course of a baseball as it makes its way through the air -- but they then need to join forces with groups of neurons in other parts of the brain, such as in regions responsible for cognition and body control.

At UC Berkeley, neuroscientists examined existing data recorded over the past four years from four macaque monkeys. Half of the subjects were engaged in brain-machine interface tasks, and the other half were participating in working memory tasks. The researchers looked at how the timing of electrical spikes -- or action potentials -- emitted by nerve cells was related to rhythms occurring in multiple areas across the brain.

Among the squiggly lines, patterns emerged that give literal meaning to the phrase "tuned in." The timing of when individual neurons spiked was synchronized with brain rhythms occurring in distinct frequency bands in other regions of the brain. For example, the high-beta band -- 25 to 40 hertz (cycles per second) -- was especially important for brain areas involved in motor control and planning.

"Many neurons are thought to respond to a receptive field, so that if I look at one motor neuron as I move my hand to the left, I'll see it fire more often, but if I move my hand to the right, the neuron fires less often," said Carmena. "What we've shown here is that, in addition to these traditional 'external' receptive fields, many neurons also respond to 'internal' receptive fields. Those internal fields focus on large-scale patterns of synchronization involving distinct cortical areas within a larger functional network."

The researchers expressed surprise that this spike dependence was not restricted to the neuron's local environment. It turns out that this local-to-global connection is vital for organizing spatially distributed neuronal groups.

"If neurons only cared about what was happening in their local environment, then it would be difficult to get neurons to work together if they happened to be in different cortical areas," said Canolty. "But when multiple neurons spread all over the brain are tuned in to a specific pattern of electrical activity at a specific frequency, then whenever that global activity pattern occurs, those neurons can act as a coordinated assembly."

The researchers pointed out that this mechanism of cell assembly formation via oscillatory phase coupling is selective. Two neurons that are sensitive to different frequencies or to different spatial coupling patterns will exhibit independent activity, no matter how close they are spatially, and will not be part of the same assembly. Conversely, two neurons that prefer a similar pattern of coupling will exhibit similar spiking activity over time, even if they are widely separated or in different brain areas.

"It is like the radio communication between emergency first responders at an earthquake," Canolty said. "You have many people spread out over a large area, and the police need to be able to talk to each other on the radio to coordinate their action without interfering with the firefighters, and the firefighters need to be able to communicate without disrupting the EMTs. So each group tunes into and uses a different radio frequency, providing each group with an independent channel of communication despite the fact that they are spatially spread out and overlapping."

The authors noted that this local-to-global relationship in brain activity may prove useful for improving the performance of brain-machine interfaces, or lead to novel strategies for regulating dysfunctional brain

networks through electrical stimulation. Treatment of movement disorders through deep brain stimulation, for example, usually targets a single area. This study suggests that gentler rhythmic stimulation in several areas at once may also prove effective, the authors said.

Other co-authors of the study are Jonathan Wallis, UC Berkeley associate professor of psychology; Dr. Karunesh Ganguly, UC Berkeley post-doctoral fellow in the Carmena lab and staff scientist at the San Francisco Veterans Affairs Medical Center; Steven Kennerley, now a senior lecturer at University College London's Institute of Neurology; Charles Cadieu, UC Berkeley post-doctoral researcher in neuroscience; and Kilian Koepsell, UC Berkeley assistant researcher in neuroscience.

The National Institutes of Health, National Science Foundation, U.S. Department of Veterans Affairs, American Heart Association, Defense Advanced Research Projects Agency and the Multiscale System Center helped support this research.

Story Source:

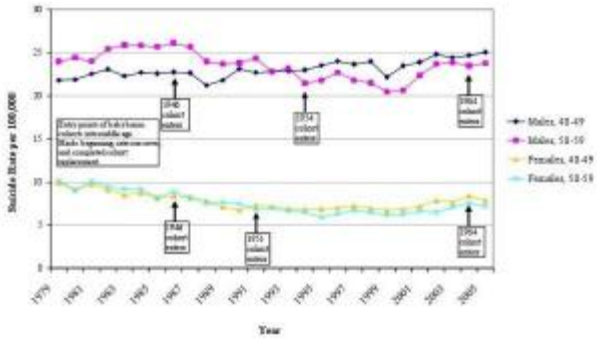
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California -- Berkeley**. The original article was written by Sarah Yang, Media Relations.

Journal Reference:

1. R. T. Canolty, K. Ganguly, S. W. Kennerley, C. F. Cadieu, K. Koepsell, J. D. Wallis, J. M. Carmena. **Oscillatory phase coupling coordinates anatomically dispersed functional cell assemblies**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1008306107

http://www.sciencedaily.com/releases/2010/09/100920151806.htm

Baby Boomers Raise Midlife Suicide Rate, Study Suggests



Baby boomers appear to be driving a dramatic rise in suicide rates among middle-aged people. (Credit: Image courtesy of Emory University)

ScienceDaily (Sep. 27, 2010) — Baby boomers appear to be driving a dramatic rise in suicide rates among middle-aged people, a new study finds. The journal *Public Health Reports* published the analysis by sociologists Ellen Idler of Emory and Julie Phillips of Rutgers University.

"The findings are disturbing, because they're a reversal of a long-standing trend," Idler says.

The suicide rate for the U.S. population overall has been declining for decades, Idler notes. And people aged 40-59, in particular, have long had a moderate suicide rate.

The baby boomers, people born between 1945 and 1964, have broken that pattern. By 2000, most people aged 40 to 59 were baby boomers and the suicide rate started climbing steadily for these middle-age ranges. The authors found significant increases of more than 2 percent per year for men, and more than 3 percent per year for women, from 1999 to 2005. (By 2005, all middle-aged people were baby boomers.)

The post-1999 increase has been particularly dramatic for those who are unmarried and those without a college degree, the analysis showed. For example, from 2000 to 2005, the suicide rate jumped nearly 30 percent for men and women aged 50 to 59 with some college but no degree. Middle-aged people with a college degree appeared largely protected from the trend.

The baby boomers also experienced higher suicide rates during their adolescence and young adulthood, doubling the rate for those age groups at the time. Their suicide rate then declined slightly and stabilized, before beginning to increase again in midlife.

"You might think that the higher rates in adolescence would lead to lower rates later because the most suicide prone people would be gone but that doesn't appear to be the case," Idler says. "Clinical studies often show that knowing someone who committed suicide is considered a risk factor for later doing it yourself, and that may be one factor here. The high rates in adolescence could actually be contributing to the high rates in middle age."

Higher rates of substance abuse and the onset of chronic diseases are among other possible factors in the rising baby boomer suicide rate. "As children, the baby boomers were the healthiest cohort that had ever

lived, due to the availability of antibiotics and vaccines," Idler says. "Chronic conditions could be more of a rude awakening for them in midlife than they were for earlier generations."

Traditionally, midlife has been considered a time when people are at their peak of social integration. "We need to pay attention to this new increase in suicides, during a period of life previously thought to be stable and relatively protected from suicide, and in an age group now occupied by extraordinarily large numbers of people," Idler says.

Data for the study were drawn from the National Center for Health Statistics and the U.S. Census Bureau. Preliminary data from 2006 and 2007, the latest time that statistics are available, indicate that the upward pattern in midlife suicide is continuing, Idler says.

Story Source:

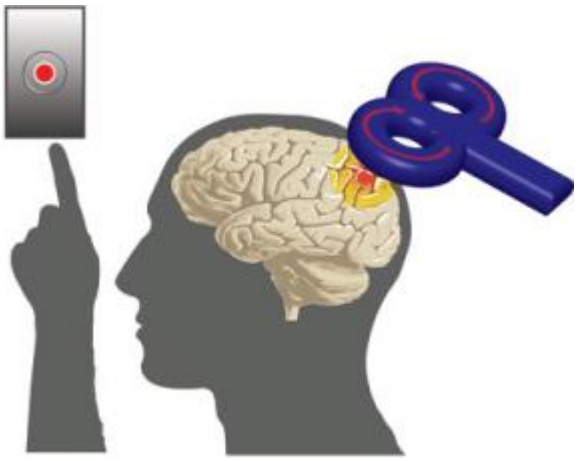
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Emory University**.

Journal Reference:

1. Julie A. Phillips, Ashley V. Robin, Colleen N. Nugent, Ellen L. Idler. **Understanding Recent Changes in Suicide Rates Among the Middle-aged: Period or Cohort Effects**. *Public Health Reports*, Volume 125, Issue Number 5 September/October 2010

http://www.sciencedaily.com/releases/2010/09/100927105201.htm

Right or Left? Brain Stimulation Can Change Which Hand You Favor



When the left posterior parietal cortex of the brain received magnetic stimulation, right-handed volunteers were more likely to use their left hand to perform simple one-handed tasks, UC Berkeley research shows. (Credit: Image courtesy of Flavio Oliveira)

ScienceDaily (Sep. 27, 2010) — Each time we perform a simple task, like pushing an elevator button or reaching for a cup of coffee, the brain races to decide whether the left or right hand will do the job. But the left hand is more likely to win if a certain region of the brain receives magnetic stimulation, according to new research from the University of California, Berkeley.

UC Berkeley researchers applied transcranial magnetic stimulation (TMS) to the posterior parietal cortex region of the brain in 33 right-handed volunteers and found that stimulating the left side spurred an increase in their use of the left hand.

The left hemisphere of the brain controls the motor skills of the right side of the body and vice versa. By stimulating the parietal cortex, which plays a key role in processing spatial relationships and planning movement, the neurons that govern motor skills were disrupted.

"You're handicapping the right hand in this competition, and giving the left hand a better chance of winning," said Flavio Oliveira, a UC Berkeley postdoctoral researcher in psychology and neuroscience and lead author of the study, published in the journal *Proceedings of the National Academy of Sciences*.

The study's findings challenge previous assumptions about how we make decisions, revealing a competitive process, at least in the case of manual tasks. Moreover, it shows that TMS can manipulate the brain to change plans for which hand to use, paving the way for clinical advances in the rehabilitation of victims of stroke and other brain injuries.

"By understanding this process, we hope to be able to develop methods to overcome learned limb disuse," said Richard Ivry, UC Berkeley professor of psychology and neuroscience and co-author of the study.

At least 80 percent of the people in the world are right-handed, but most people are ambidextrous when it comes to performing one-handed tasks that do not require fine motor skills.

"Alien hand syndrome," a neurological disorder in which victims report the involuntary use of their hands, inspired researchers to investigate whether the brain initiates several action plans, setting in motion a competitive process before arriving at a decision.

While the study does not offer an explanation for why there is a competition involved in this type of decision making, researchers say it makes sense that we adjust which hand we use based on changing situations. "In the middle of the decision process, things can change, so we need to change track," Oliveira said.

In TMS, magnetic pulses alter electrical activity in the brain, disrupting the neurons in the underlying brain tissue. While the current findings are limited to hand choice, TMS could, in theory, influence other decisions, such as whether to choose an apple or an orange, or even which movie to see, Ivry said.

With sensors on their fingertips, the study's participants were instructed to reach for various targets on a virtual tabletop while a 3-D motion-tracking system followed the movements of their hands. When the left posterior parietal cortex was stimulated, and the target was located in a spot where they could use either hand, there was a significant increase of the use of the left hand, Oliveira said.

Other coauthors of the study are Jörn Diedrichsen from University College London, Timothy Verstynen from the University of Pittsburg and Julie Duque from the Université Catholique de Louvain in Belgium.

The study was funded by the Natural Sciences and Engineering Research Council of Canada, the Canadian Institutes of Health Research, the National Institutes of Health, the National Science Foundation and the Belgian American Educational Foundation.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California -- Berkeley**. The original article was written by Yasmin Anwar, Media Relations.

Journal Reference:

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http://www.sciencedaily.com/releases/2010/09/100927162302.htm

Daycare Puts Children With Lung Disease at Risk for Serious Illness, Study Finds

ScienceDaily (Sep. 27, 2010) — Exposure to common viruses in daycare puts children with a chronic lung condition caused by premature birth at risk for serious respiratory infections, according to a study from Johns Hopkins Children's Center published in the October issue of *Pediatrics*.

The researchers say their findings should prompt pediatricians to monitor their prematurely born patients, regardless of age, for signs of lung disease and to discuss the risks of daycare-acquired infections with the children's parents. These risks, the researchers found, include increased emergency room visits and medication use and more days with breathing problems.

"Daycare can be a breeding ground for viruses and puts these already vulnerable children at risk for prolonged illness and serious complications from infections that are typically mild and short-lived in children with healthy lungs," said lead investigator Sharon McGrath-Morrow, M.D., M.B.A., a lung specialist at Hopkins Children's.

Investigators interviewed the parents of 111 children ages 3 and under with chronic lung disease of prematurity (CLDP) about their child's daycare attendance, infections, symptoms, emergency room visits, hospitalizations and use of medications.

Children with CLDP who attended daycare (22 out of the 111) were nearly four times more likely to end up in the ER with serious respiratory symptoms than those who didn't attend daycare, were twice as likely to need corticosteroids, and were more than twice as likely to need antibiotics. Children who attended daycare were nearly three times more likely to have breathing problems at least once a week compared to those not attending daycare.

Because the often serious complications caused by these infections can land children in the hospital and require prolonged treatment, the investigators are urging pediatricians to make parents aware of the risk.

"Repeated infections in children with lung disease of prematurity can also put them on a fast track to lifelong respiratory problems and chronic lung damage, so prevention in early life is crucial," McGrath-Morrow says.

The researchers advise parents of children with CLDP to avoid -- whenever possible -- sending their children to daycare during the first two years of life because most of the catch-up lung growth occurs during that time. Most children with CLDP improve with age as their lungs mature, but about one-fourth continue to have respiratory problems as adults, the investigators say.

Among the 22 children with CLDP who attended daycare, 37 percent went to the ER for worsening symptoms since their last day in daycare, compared to 12 percent of children who did not attend daycare. More than 15 percent of those who attended daycare were hospitalized for viral illness, compared to 6 percent among those who didn't attend daycare. Thirty-nine percent of those in daycare needed corticosteroids for their illness and 50 percent of them required antibiotics, compared to 19 percent and 26 percent, respectively, for those who were not in daycare. Children in daycare had more respiratory episodes in the week before their visit to the doctor. More than half of the children in daycare had respiratory symptoms in the week before their visit, compared to 29 percent of those not enrolled in daycare.

CLDP develops in about a quarter of babies born at or before 26 weeks of gestation, according to the investigators, but even those born as late as 32 weeks of gestation can develop the condition, the researchers say.

The research was funded by the Thomas Wilson Sanitarium for Children and the National Institutes of Health.

Co-investigators on the study included Grace Lee, B.A.; Beth Stewart, M.M.; Brian McGinley, M.D.; Maureen Lefton-Greif, Ph.D.; Sande Okelo, M.D.; and J. Michael Collaco, M.D., M.B.A., all of Hopkins.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Johns Hopkins Medical Institutions**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Sharon A. McGrath-Morrow, MD, Grace Lee, BA, Beth H. Stewart, MM, Brian M. McGinley, MD, Maureen A. Lefton-Greif, PhD, Sande O. Okelo, MD, J. Michael Collaco, MD. **Day Care Increases the Risk of Respiratory Morbidity in Chronic Lung Disease of Prematurity**. *Pediatrics*, September 27, 2010 DOI: 10.1542/peds.2010-0844

http://www.sciencedaily.com/releases/2010/09/100927083815.htm

Braces For Young Kids Might Not Always Be Best

by Allison Aubrey

September 27, 2010

If you walk the halls of an elementary school, you're likely to see a lot of "metal mouths." Many parents are now opting for early orthodontic treatment, and the American Association of Orthodontists recommends that children see an orthodontist for an evaluation no later than age 7. But research shows there are often advantages to deferring treatment, though decisions are made on a case-by-case basis.

"There's been a number of studies that have shown for some very common problems that you're better off waiting until all the permanent teeth have come in first before treatment is started," says Robert Williams, a board certified orthodontist who teaches at the University of Maryland.

Common problems that fall into the "better-to-defer" category include conditions such as overjets — that's when teeth protrude or stick out — or crooked teeth that just need simple straightening.

"Many years ago, you wouldn't do anything until the permanent teeth were all in," says Antonino Secchi, a professor of orthodontics at the University of Pennsylvania. Now he says if parents opt to treat an overjet early — say at age 9 — the child may end up needing another phase of intervention a few years down the road.

"And at the end, instead of having two years of orthodontics, you end up having four years of orthodontics," Secchi says. And he says this can be much more expensive. "Instead of paying one bill, you pay two bills."

Evaluating Treatment Options

Orthodontists have varying payment structures. Sometimes families are given a break or a discount on a second phase of treatment. "You want to get the most bang for the least number of bucks," Williams says. So, when parents are trying to decide on the best treatment plan, he says, they should ask questions until they understand the pros and cons of each option.

"I definitely asked a lot of questions," says Mary Bateman, whose 9-year-old daughter Rachel is being treated for a crossbite. That's when upper teeth bite down on the inside of the lower teeth. If left untreated, it could lead to problems like damaging the gum tissue.

"This is the kind of problem that we pretty much always treat early," Williams says. Other conditions that warrant early intervention include overbites or severe crowding.

In Rachel's case, the ideal time to intervene is between the ages of 6 and 9.

"When the baby teeth are still in, we have more treatment options because we have more flexibility in moving the teeth," Williams says.

The Batemans ended up at the University of Maryland orthodontic clinic after an evaluation by another orthodontist recommended an expander to correct the overbite. "I didn't just jump into it," says Mary Bateman. Over the course of getting orthodontic treatment for her three older children, she learned that

expanders aren't the best option for every case, though many orthodontists recommend them in certain circumstances.

"In some cases expansion of the upper arch [using an expander] is not a stable position," Williams says. He opted to treat Rachel Bateman's overbite by extracting a few baby teeth and putting on braces to move a problem tooth. Williams says some people don't realize that expansion may relapse and not hold, so some patients may need to wear retainers indefinitely to maintain the extra space in their mouths.

Form Vs. Function

Orthodontists have varying approaches, and there isn't one right way or wrong way to treat a problem. Patients, likewise, have different expectations. Many parents put a strong emphasis on a beautiful smile over fixing functional dental problems. This is the case with Pamika Lee, the mother of 15-year-old Quinique Jones.

"I looked at her teeth today, and they are beautiful," Lee says. "Perfect." Jones is about to get her braces off, and Lee says her daughter's self-confidence is already improved.

As orthodontists blend aesthetic, or cosmetic, interventions with the business of fixing dental problems, people who have just marginal cases of crooked or crowded teeth are increasingly opting for treatment. Lee says she's considering it herself — when she can afford it.

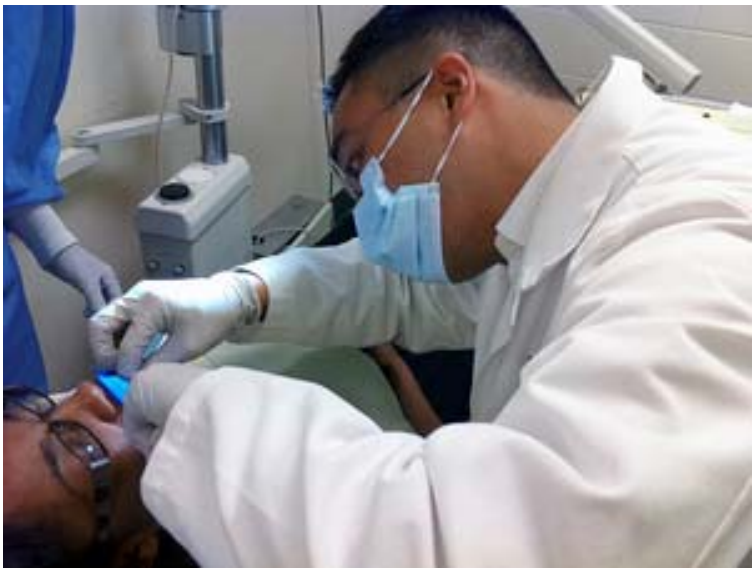
"I may get braces soon," Lee says. And she'll be in good company — the American Association of Orthodontists now says 1 in 5 new patients is an adult.

"Some of my patients are in their 60s and 70s," Williams says. "It's never too late."

http://www.npr.org/templates/story/story.php?storyId=130073442&sc=nl&cc=hh-20100927

A No-Cringe Fix? Filling Cavities Without The Drill

by Gretchen Cuda



Gretchen Cuda for NPR

Using the Icon treatment, Dr. Jin-Ho Phark won't need to drill to fill a cavity.

September 27, 2010

It's just past 8 a.m., and Kimberly Baker is reclining in the dental chair at Case Western Reserve University's School of Dental Medicine in Cleveland.

Baker has three cavities. This morning, she'll be getting two of them drilled the old-fashioned way. But the third is a decay that is not so advanced, and Dr. Jin-Ho Phark, her dentist, is going to use a treatment he's testing that involves no drilling — "which is nice because many patients don't like the sound of the drill, and the feeling or the pain that might be associated with it," Phark says.

That cringe-worthy sound may be on the way out. A new procedure used by Phark and other doctors claims to stop the progress of cavities without drills or Novocain.

The treatment, called Icon, is one of several new cavity treatments that avoid drilling. Icon was developed in Germany and has been available in the U.S. for just over a year. It's intended for patients whose decay has not gone beyond the tooth enamel.

To Drill Or Not To Drill

Phark says that when decay is caught very early or very late, dentists have a clear course of action: Early problems can often be reversed with better brushing, fluoride or calcium-containing toothpastes — and late-stage cavities need to be filled. But at the intermediate stages, dentists don't have many options.

"In many of those cases we decide, 'OK, this lesion is too small to be treated with a filling.' So, we are actually waiting until the lesion grows bigger and bigger and becomes deep enough and worthy to be drilled out and be filled," Phark says.

German researcher Sebastian Paris is a dentist and one of the drill-less cavity treatment's developers.

"We aim to treat these intermediate lesions — not the very early ones, but the intermediate ones — where usually, as a dentist, you are not sure whether you should make a filling or not," Paris says.

How It Works

When tooth decay begins, minerals, like calcium, are leached out of the tooth enamel, leaving behind sponge-like pores in the enamel. If the decay process is allowed to continue, the pores grow and form a hole, known as a cavity.

The new treatment uses a coating of mild acid that is applied to the decay to open up a route to the pores and clear out decayed enamel. Then the open pores are filled with a clear resin.

Gretchen Cuda for NPR

Studies say the Icon resin treatment stops decay 85 percent of the time.

Paris says the key to getting the treatment to work was finding a filling material that wasn't thick and goopy so the porous enamel would immediately suck it up like a sponge.

"When you take a sugar cube and you put it into your coffee, you will see that it is soaked up with the coffee," Paris says. "But if you put your sugar cube into honey, you can imagine that it will take ages to soak into the sugar cube."

Cheaper, Lighter Alternatives To The Drill

Avoiding the drill has the advantage of preserving and extending the life of the natural tooth. However, some dentists argue that any time before a cavity actually forms, tooth decay can be stopped — and even reversed — by the patients themselves, using, for example, fluoride toothpaste.

"An alternative could simply be brushing better in a certain location and not drinking Coca-Cola all day long," says Mark Wolff, a professor of dentistry at New York University who specializes in cariology, or the study of tooth decay.

Wolff says that while the no-drill approach to treating this type of tooth decay has promise, fluoride treatments and other patient-applied methods are still more inexpensive, less invasive and have a much longer track record of success.

"Might this be a good application to help that person recover or prevent this decay from advancing? Absolutely. I think the jury is still out on the product a little bit. Hopefully it works. It's just still in its earliest stages," Wolff says.

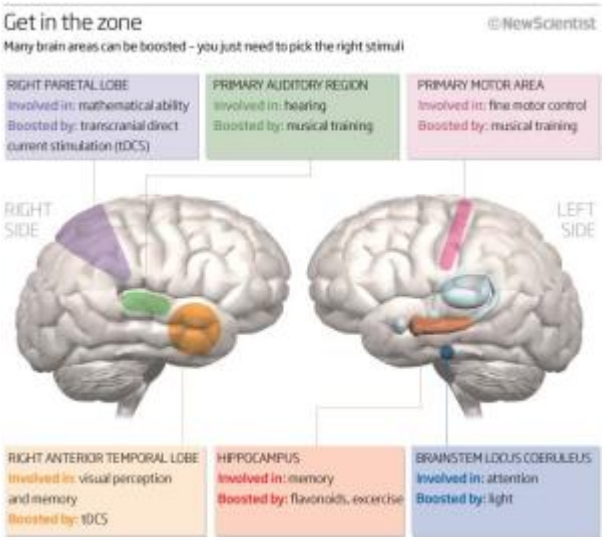
Because it's so new, it's still unclear how the Icon resin filling holds up over time. And clinical studies have shown that the treatment fails to stop decay from advancing up to 15 percent of the time.

But Wolff says that for patients who aren't able or willing to change their dental hygiene habits, or who are predisposed to tooth decay, this may be a good solution for keeping the dentist's drill at bay.

http://www.npr.org/templates/story/story.php?storyId=130070080&sc=nl&cc=hh-20100927

Mental muscle: six ways to boost your brain

- 29 September 2010 by **Helen Thomson**
- Magazine issue 2780.



Get in the zone

Brain training games won't make you smarter – but a dose of blue light or an electrical shock just might

BREATHE in, breathe out. Breathe in, breathe out. I crack open an eye. Everyone else has theirs closed. I shut it again. Breathe in, breathe out. Around me people are sitting crossed-legged, meditating. For some it's spiritual, for others an oasis of calm. Me? I'm building a better brain.

A few months ago I would probably have bought a brain-training game, but alas, it turns out they are probably useless. Although your performance on the games improves, that effect doesn't seem to translate into the real world (see "The rise and fall of brain training"). With that in mind, I wondered if there was anything else I could do to give my grey matter a boost.

Our brains are constantly adapting to information from the world around us. However, some activities make a bigger impression than others. In recent years, researchers have been probing how outside influences, from music to meditation, might change and enhance our brains.

One of the most promising is music - and not via the famous but controversial "Mozart effect", whereby merely listening to classical music is supposed to improve brain performance. Learning to play an instrument brings about dramatic brain changes that not only improve musical skills but can also spill over into other cognitive abilities, including speech, language, memory, attention, IQ and even empathy. Should I dust off my trumpet and get practising?

Musical training, especially at a young age, seems to significantly alter the structure of your brain. For instance, after 15 months of piano lessons young children had more highly developed auditory and motor

areas than their untrained peers. These brain areas are very active when you play an instrument (*Journal of Neuroscience*, vol 29, p 3019).

Professional musicians have an increased volume of grey matter, which routes information around the brain, in areas that deal with motor control, audition and visuo-spatial processing (*Journal of Neuroscience*, vol 23, p 9240). Musicians who started training before the age of 7 also have a thicker corpus callosum, the bundle of nerve fibres that shunts information between the two halves of the brain (*Neuropsychologia*, vol 33, p 1047).

These structural changes have been shown to tally with the development of musical ability. But can music reach outside of its own domain and improve other aspects of cognition?

The tentative answer is yes. Musically trained people perform better on tests of auditory memory - the ability to remember lists of spoken words, for example - and auditory attention. Children with a musical training have larger vocabularies and higher reading ability than those who do not (*Nature Reviews Neuroscience*, vol 11, p 599). There is even some evidence that early musical training increases IQ (*Psychological Science*, vol 15, p 511).

Better learning

Patrick Ragert at Ruhr-University Bochum in Germany and colleagues have an idea why this should be so. They found that professional pianists were much better than non-musicians at a standard test of spatial acuity - the ability to discriminate two closely separated points. Crucially, they also improved faster with practise (*European Journal of Neuroscience*, vol 19, p 473). This is evidence that the brains of trained musicians are more plastic, says Ragert, suggesting that learning an instrument may enhance your capacity to learn other skills.

This can even extend to languages. Trained musicians are better at discriminating pitch changes in made-up words similar to those found in Mandarin, a "tonal" language where such changes can alter the meaning of a word. This is evidence that they are better equipped to learn new languages (*Applied Psycholinguistics*, vol 28, p 565). And that is not all. Music training has even been shown to enhance empathy because it fine-tunes your ability to recognise emotional nuances in speech (*Annals of the New York Academy of Sciences*, vol 1169, p 209).

Much of this research has been done in children or professional musicians who started training very young. Developing brains are known to be more malleable than adult ones - for music, there seems to be a sensitive period at around 7. So would the same kind of training make any difference to me? "Those who begin musical training earlier in life see greater enhancements," says Dana Strait, who works in music cognition at Northwestern University in Evanston, Illinois. "But all signs point toward musical training being powerful at any point in life."

All the signs point to musical training being powerful at any point in life

So if I resumed trumpeting where I left off, I could potentially enhance my brain in all sorts of ways (while simultaneously delighting my neighbours, no doubt). But years of practise seemed a little daunting, so I went off in search of a shortcut.

That's why I found myself sitting in a small room with two electrodes stuck to my head. It sounds like something you'd see in an episode of *24*, but I was being set up for a trial of transcranial direct current stimulation (tDCS), a way of enhancing brain activity using an electrical current.

The current is tiny - just 1 to 2 milliamps - and though the mechanism is not fully clear, tDCS appears to increase the excitability of neurons, making active areas of the brain work even harder. Depending where you place the electrodes, it can lead to an enhancement in cognitive functions including attention and vision (*Neuropsychologia*, vol 48, p 2789).

Roi Cohen Kadosh, a neuroscientist at the University of Oxford, is particulary interested in tDCS's potential to give our brains a boost. He has been looking for the part of the brain that is responsible for mathematical ability. In 2007, he pinpointed this to the right parietal lobe, just above the right ear. When his team "short-circuited" this area using transcranial magnetic stimulation (TMS) - a stream of magnetic pulses which temporarily disables a targeted area of the brain - they found that people got worse at numerical tasks. In fact, their performance resembled people with dyscalculia, who have difficulty comprehending mathematics.

Having disrupted our ability to use numbers, Cohen Kadosh wondered whether he could improve it too.

He now has his answer. Cohen Kadosh managed to improve numeracy in volunteers by applying tDCS to the right parietal cortex.

He zapped his volunteers while they familiarised themselves with made-up symbols representing the numbers 1 to 9. The volunteers had no idea which symbols stood for which number but had to work it out by trial and error. After each training session they were given tests to see how well they could perform calculations using the symbols.

Those given tDCS learned the symbols faster and did better in the tests than those given a sham procedure. It did not affect other brain functions, Cohen Kadosh's team found.

Cohen Kadosh, who announced his results at a conference at the University of Oxford in June, had another surprise in store - the improvements have lasted six months so far.

Since we constantly encounter numbers in our daily life, Cohen Kadosh said it is really important that people who have difficulties with numbers know about these kind of options for improving their cognition, as an alternative to drug therapies.

Electricity can also boost visual memory. Richard Chi and colleagues at the University of Sydney, Australia, used tDCS to increase activity in the right anterior temporal lobe, near the temple, which is involved in visual perception and memory. His volunteers experienced a 110 per cent improvement in a subsequent visual memory task compared with a group who received a sham treatment (*Brain Research*, vol 1353, p 168).

It doesn't take a huge leap of imagination to see where this could all be heading. Cohen Kadosh reckons tDCS could be packaged into a portable gadget. "In the future I can see it being of use in schools or at home, to advance the abilities of children with learning difficulties." He says that it is much safer than other types of brain stimulation because tDCS does not cause neurons to fire directly, it merely makes them more responsive.

Bright lights

Direct current may not be the only way to boost your brain at the flick of a switch. Light, too, can have some surprising effects on cognition that have nothing to do with vision.

We understand pretty well how our brains process visual information and use light to regulate the body clock and hormone secretion, but have only just begun to realise the extent to which light can directly affect brain function. Several studies have shown that simply exposing people to light improves performance on many cognitive tasks.

In these studies, volunteers with normal vision were given a variety of tests while exposed to bright light during the day. Their performance in visual searches, mathematics, logical reasoning and reaction time all improved with exposure to bright light (*Trends in Cognitive Sciences*, vol 13, p 429).

This appears to be because light boosts alertness. In another study, volunteers had their brains scanned as they performed a short-term memory task while exposed to either violet, blue or green light. The scans revealed that after just a few seconds of light exposure an area of the brain stem known to play a role in alertness became more active (*PLoS One*, vol 2, p 1247). Blue light was the most potent. Similarly, in simple reaction tasks, exposure to blue light is more effective in sustaining cognitive performance than green light (*Sleep*, vol 29, p 161).

These effects are probably mediated by a recently discovered pigment in the retina called melanopsin, which is not involved in vision. Melanopsin absorbs pale blue light better than other wavelengths, which is not surprising as natural light contains a lot of blue. But exactly how it boosts cognition remains unclear.

"No doubt further research will expand our understanding of the characteristics of the light environment that are required to optimise brain function," says Gilles Vandewalle, a neuroscientist at the University of Montreal, Canada.

That, however, is one for the future. I am looking for a brain boost right now. Perhaps I should stop thinking about my brain and concentrate on my stomach.

Brain food

Many foods contain chemicals that have been claimed to boost mental performance. Perhaps the most famous are omega-3 fatty acids, found naturally in oily fish, walnuts and green vegetables, and increasingly added to processed foods such as bread and yoghurt. For years these have been touted as the quintessential brain food - but the most recent evidence suggests that they do little or nothing to improve mental powers (*New Scientist*, 15 May, p 32).

Even so, the dream of brain-boosting through diet lives on. Attention has now shifted to another group of chemicals, the flavonoids, found in fruits such as blueberries and blackcurrants and also in cocoa, green tea and red wine.

Jeremy Spencer at the University of Reading, UK, is investigating the brain-enhancing effects of food. In experiments on rodents his team has shown that eating dietary quantities of flavonoids can lead to enhancements in memory and protect against degeneration of the brain (*Chemical Society Reviews*, vol 38, p 1152).

A pilot study suggests that something similar applies to humans. "We looked at the effect of blueberries and found they improve attention," says Spencer.

Spencer also took blood samples from the volunteers. These suggest that flavonoids activate biochemical pathways that increase the expression of genes linked to memory.

For example, flavonoids are able to raise levels of brain-derived neurotrophic factor (BDNF), a protein known to be important for learning and memory. BDNF is a growth factor that stimulates the development of axons linking one brain cell to the next.

Spencer suggests that the effect may also trigger increased communication between brain cells. However, flavonoids are also known to affect the circulatory system, lowering blood pressure and increasing elasticity of blood vessels. In this way, they have been shown to increase blood flow to the brain. This is known to be good for mental performance, possibly via the generation of new neurons in the hippocampus through the triggering of stem cell differentiation. "Eating blueberries could stimulate neuronal growth through increased blood flow to this area," says Spencer.

"They appear to have almost drug-like effects," Spencer adds. "It's quite possible that these food-derived components may be used in the future as precursors for mind-enhancing drugs."

Chris Bird, a neuroscientist at University College London, says that the preliminary results look promising, but questions whether a flavonoid-rich diet would have noticeable effects in the real world. "I will continue to eat them and hope that they might be doing something good for me," he says.

Another promising compound is based on magnesium. Earlier this year Guosong Liu and colleagues at the Massachusetts Institute of Technology reported the results of feeding a magnesium compound, magnesium-L-threonate (MgT), to rats. They found it significantly raised magnesium levels in the brain and led to increases in both spatial and associative memory in young and old rats (*Neuron*, vol 65, p 165). Liu also showed that boosting magnesium in the brain increases synaptic plasticity in neurons and neurogenesis - the production of new neurons - in the hippocampus. If it can be safely adapted to humans, the authors suggest that this dietary supplement could boost cognition.

And after all that brain food, it might be time to pay a visit to the gym. While regular exercise certainly increases blood flow to the brain, in rats at least, whether it holds true for humans is still a matter of debate.

Since monkeys are more comparable to humans, Judy Cameron at the University of Pittsburgh, Pennsylvania, trained monkeys to use treadmills to see if it affected their mental agility. One group of monkeys worked out for an hour a day five days a week. Another group spent the time sitting on an immobile treadmill. Five weeks in, all the monkeys were given a task where they had to learn which object covered a food reward. The monkeys that had worked up a sweat were twice as fast at this exercise as those that had been sedentary (Neuroscience, vol 167, p 1239).

Analysis of brain tissue showed that the runners had a greater volume of blood vessels. Since blood delivers oxygen and nutrients to the brain, this could explain why exercise increased their cognitive function.

Concrete evidence that exercise improves brain function in humans has been harder to find. Numerous studies have shown that moderate exercise can slow age-related decline. But in August, researchers at the University of Illinois at Urbana-Champaign showed that daily walking improved executive functions such as planning and abstract thinking in younger adults (*Frontiers in Ageing Neuroscience*, vol 2, article 32).

Although scientists still do not know how exercise benefits the brain, studies like these, together with those in animals, hint that physical activity may spur the growth of neurons in regions important to memory and improve activity in areas that are responsible for executive function.

Key chemicals that might be involved include BDNF and vascular endothelial growth factor (VEGF), which aids blood vessel growth. Several animal studies have shown greater concentrations of these chemicals in animals that have exercised, suggesting that a workout literally helps them grow a better brain. In humans BDNF levels have also been shown to increase after exercise.

In both animals and humans, excessive exercise had the opposite effect, diminishing levels of BDNF, which might mean that moderate bursts of activity promote the right chemical building blocks for a better brain.

So if I can improve my brain with music, light, blueberries and exercise, why am I here, sitting crossed-legged, concentrating on my breathing?

Humans have strived to gain enlightenment and control over the mind through meditation for centuries. But while practitioners have claimed a number of brain benefits, few have been well tested scientifically.

Meditate to accumulate

So when, in 2005, the Dali Lama famously challenged neuroscientists to test the memories of monks, several groups of investigators jumped at the chance. They travelled to monasteries in Nepal to test Buddhist monks. The initial results were disappointing. They found no difference in visual memory tests between monks who meditated regularly and non-meditators.

Then they tested a monk immediately after a meditation session. "He showed unbelievable performance," says Maria Kozhevnikov, then at George Mason University. It turns out just 20 minutes of daily yoga meditation improved both visual memory and spatial skills dramatically, but the boost was short-lived (*Psychological Science*, vol 20, p 645).

Just 20 minutes of yoga-based meditation improves both visual memory and spatial skills

Since then, evidence has piled up that intensive meditation training - say 10 hours a day for three months - enhances attention and executive function. And earlier this year a team led by Fadel Zeidan of Wake Forest University School of Medicine in Winston-Salem, North Carolina, reported that just four 20-minute training sessions improved visuo-spatial processing, working memory and executive functions in people who had never meditated before (*Consciousness and Cognition*, vol 19, p 597). Bruce O'Hara at the University of Kentucky in Lexington even showed that meditation appears to improve vigilance and reaction times (*Behavioral and Brain Functions*, vol 6, p 47).

Do these findings suggest that it's worth practising meditation before doing something mentally challenging? Although the data is limited, O'Hara thinks it might help. "Meditating prior to studying or taking an exam could be beneficial. The improvements may be small, but worthwhile."

So who needs brain training? With so many options at my disposal, I have no excuse for not keeping my brain in tip-top condition. The right diet, a spot of exercise and meditation and a bit of sunshine are all I need. Perhaps some of it really will help me to build a better brain over the coming years. At the very least, I've got an excuse for a glass of red wine.

The rise and fall of brain training

Once touted as the fastest way to hone your mental powers, brain training software has now been consigned to the shelf of technologies that failed to live up to expectations. What went wrong?

The big question was whether getting better at the game would translate into general cognitive improvements. Some trials have shown success, but have been criticised for being too small to produce meaningful results.

No large, published trial has yet shown concrete evidence that brain training has an effect on real world activity. In fact, the largest trial ever found that it doesn't work.

Early this year, a team led by Adrian Owen of the MRC Cognition and Brain Sciences Unit in Cambridge, UK, got over 11,000 volunteers to do either online brain training or surf the web to find answers to a set of obscure questions.

All the volunteers showed improvements in the task they were assigned, but there was no difference between the groups on other tests of cognition. The conclusion? There's no evidence that brain trainers improve general cognitive functioning (*Nature*, vol 465, p 775).

Helen Thomson is New Scientist's biomedical news editor

http://www.newscientist.com/article/mg20827801.300-mental-muscle-six-ways-to-boost-your-brain.html?DCMP=NLC-nletter&nsref=mg20827801.300

Rivers threatened around the world

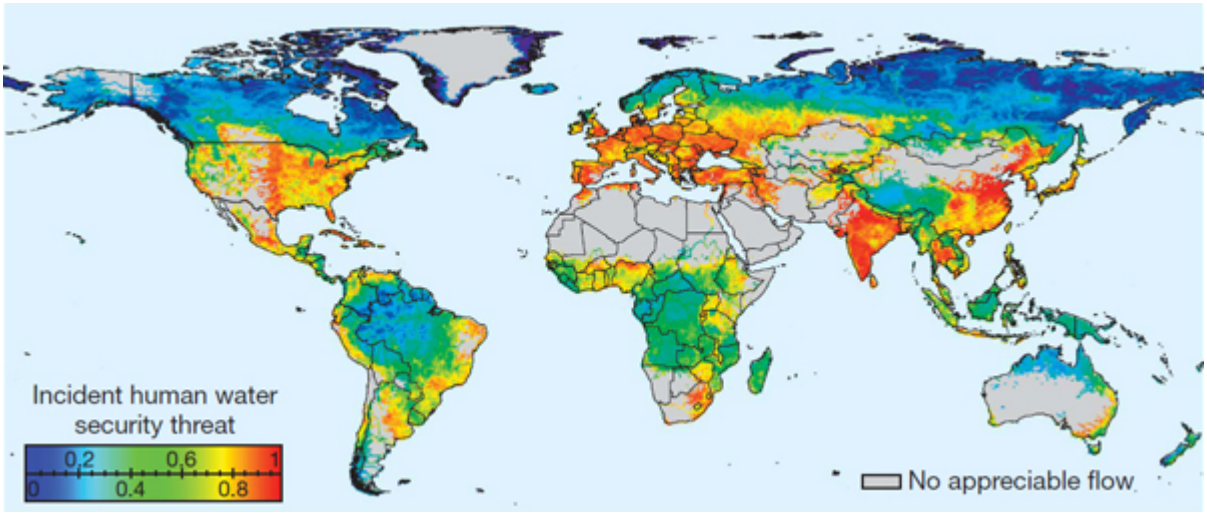
18:01 29 September 2010
Environment
Science In Society

Michael Marshall, environment reporter

The water supplying 80 per cent of the world's population is exposed to "high levels of threat". That's the conclusion of a study that surveys the status of rivers throughout the world, and looks at their effects on both humans and the ecosystem at large.

Writing in this week's *Nature* (vol 467, p 555), Charles Vorosmarty of the City College of New York and colleagues pull together a swathe of data on factors affecting water security, from dams that reduce river flow to the pollution and destruction of wetlands.

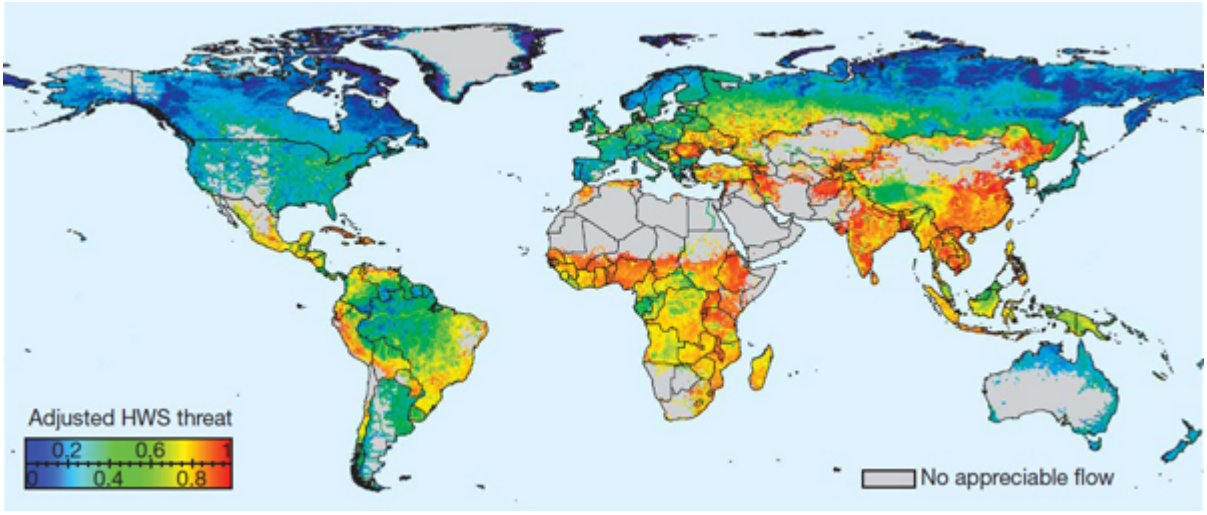
They produce two maps showing the levels of threat to humans and to ecosystems that rely on rivers. The maps are virtually identical, with the continental US, Europe and south-east Asia facing the greatest threats, to both humans and the wider ecosystem.



The map above shows the level of threat to humans: blue means low threat, and red means high threat. The grey areas are deserts with little or no water flow.

Readers in the UK and US may be wondering when such threats will materialise, given that these regions rarely experience anything much worse than a hosepipe ban. In fact, the human threat map is not the whole story: most developed countries have technology in place to combat water shortages, like reservoirs and distribution pipelines.

When the team plugged these factors into their model, the threats to humans look a little different:



Once investment in technology is factored in, it turns out that the people most at risk from water shortages live in Asia and sub-Saharan Africa - which is about what you'd expect.

Technology, it seems, can insulate humans from the effects of water shortages if you can afford it. But so far it hasn't made a dent in the accompanying threat to wildlife, the researchers write.

They also point out that many of the technologies that stabilise water supplies for humans, such as irrigation systems and reservoirs, are to blame for the threats to ecosystems. That's neatly captured in this last map, which contrasts the two types of threat.

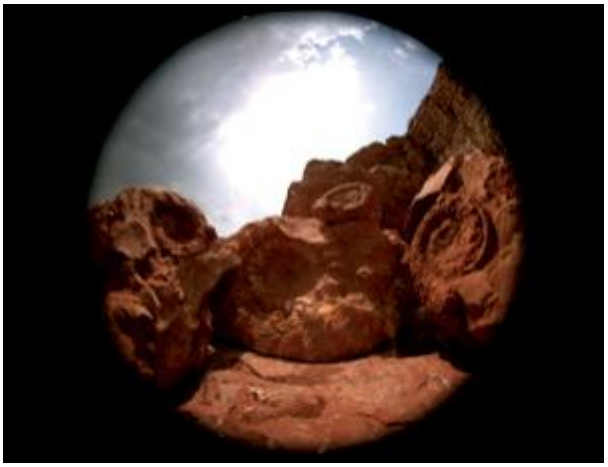
The message of this last map is stark: that wildlife is threatened by water shortages everywhere humans live in large numbers, and that human security is threatened only where people are too poor to afford the technology that could protect them.

(Images: Nature)

http://www.newscientist.com/blogs/shortsharpscience/2010/09/rivers-threatened-around-the-w.html

Fossil secrets of the da Vinci codex

- 29 September 2010 by **Jo Marchant**
- Magazine issue 2780.



Da Vinci realised people were wrong about the origin of Italy's fossils (Image: Ted Spiegel/Corbis)

Did Leonardo decipher traces of ancient life centuries before Darwin?

It was to be Leonardo da Vinci's most impressive work yet. In 1483, the Duke of Milan, Ludovico Sforza, commissioned the up-and-coming artist to create a huge bronze statue of a horse, standing over 7 metres tall. Da Vinci spent the next 10 years perfecting a full-size clay model. Sadly, it was never cast in bronze. Tonnes of the metal were needed, and Sforza ended up using the earmarked supplies to make weapons for use against invading French troops. When the French army took Milan in 1499, its archers used da Vinci's clay horse for target practice.

Those years in Milan were nevertheless important for da Vinci, and not only for the many masterpieces he painted in that time. The polymath was also working on a very different project inspired by an intriguing feature of the surrounding countryside: embedded in the rocks there appeared to be a multitude of small stone sea creatures. "The hills around Parma and Piacenza show abundant molluscs and bored corals still attached to the rocks," da Vinci wrote a few years later. "When I was working on the great horse in Milan, certain peasants brought me a huge bagful of them."

Da Vinci recorded his observations of these and other fossils in a secret notebook now known as the *Codex Leicester*. His findings have long been known to be ahead of their time, but a new analysis suggests that the work was even more advanced than previously thought, with da Vinci correctly deciphering not only the origin of body fossils, which are the direct remains of an animal, but also trace fossils - the tracks and burrows left behind by ancient creatures. Such ideas would only be matched by modern naturalists hundreds of years later (see timeline).

The origin of body fossils was the subject of fierce debate in da Vinci's time. The ancient Greeks understood that seashells embedded in rocks were the remains of prehistoric creatures deposited on the floor of a sea that had once covered the land. But the idea had been lost with the collapse of their civilisation, and by the time of the Renaissance, most scholars were confounded by the shells. There were two main theories to explain them: one claimed that the shells were inorganic structures that had grown spontaneously within the rock. The fact that they mimicked living creatures wasn't considered too strange - it was simply thought to reflect the harmony that existed between the various realms of nature. The other theory claimed that the shells were the remains of sea creatures that had been deposited on mountaintops during the great flood described in the Bible.

Curious discoveries

Indeed, it took until the late 18th century for scholars to accept the idea that body fossils were in fact the remains of living creatures preserved in sediment. The study of trace fossils, a field called ichnology, came even later, with the first scientific observations of fossil footprints. In a letter written in 1845, Charles Darwin described the identification of such footprints as "one of the most curious discoveries of the present century and highly important in its several bearings". The ambiguous burrows and trails left by invertebrates crawling through the sediment were even more difficult to interpret. Naturalists initially thought they represented fossilised seaweed, and it was only in the late 19th century and early 20th century that their true origin was elucidated.

Da Vinci had worked all this out long ago. He was inspired by a geological formation between Milan and Florence known as the Apennine foredeep deposit. Ten million years ago, this region was a marine basin that formed next to the Apennine mountains as clashing tectonic plates caused the entire region to rise. Seismic shocks triggered currents that carried huge volumes of sand down to the seabed, which subsequently turned into sedimentary rock.

Today this area is characterised by picturesque hills laden with olive groves and vineyards, with the Apennine peaks visible in the distance. Rivers have cut deep into the landscape, creating rocky cliffs of alternating layers of sandstone and marl. Da Vinci is known to have studied bird flight here, but it is also the perfect place for fossil hunting.

Da Vinci used the observations he made in these hills to counter both of the prevailing theories for how fossils came about. He refuted the flood theory by observing that the fossils tend to be found in several superposed layers throughout the rock. From this, he inferred that they must have been deposited at several different times, rather than in one catastrophic event.

Da Vinci was positively withering when he considered the inorganic theory. He pointed out that marine fossils are only ever found in sedimentary rocks that appear to be of oceanic origin. Yet if the fossils were inorganic, they would presumably grow in all types of rocks. And if the stony shells had grown from seeds within the rocks, how could they expand each year, as indicated by growth bands on their shells, without fracturing the material that surrounded them? Only "ignoramuses" would believe such a thing, he wrote.

Crucial to da Vinci's case against the two theories, though, would have been his understanding of trace fossils, says Andrea Baucon, a palaeontologist based at UNESCO's Naturtejo Geopark in Idanha-a-Nova, Portugal. This discovery, had it been reported publicly, would have been the crowning glory of his evidence against the inorganic and flood theories of fossil origins. Instead, it was overlooked for centuries.

Baucon started reading the *Codex Leicester* as part of a project on geology and art. The codex consists of 18 yellowed sheets of paper, each densely covered on both sides with da Vinci's back-to-front mirror writing, along with copious messy sketches. It became the most expensive book in the world when Bill Gates bought it for over $30 million in 1994.

Although he couldn't access the *Codex Leicester* directly, Baucon studied scanned images of the pages, and was amazed to discover what could best be described as an ichnological observation. On the reverse side of the tenth page, da Vinci had written: "Among one and another rock layers, there are the traces of the worms that crawled in them when they were not yet dry."

Baucon describes this as his "eureka moment". Scholars had read the line before, but none had fully grasped its implications. From this one sentence, Baucon realised that centuries before other scientists, da Vinci had correctly interpreted both the biological origin of the fossil traces and the process by which they had become fossilised (*Palaios*, vol 25, p 361). "The modern interpretation is that these 'rock scribbles' were produced by worm-like organisms in marine environments, when the sediment was still loose," says Baucon. "This corresponds to da Vinci's observations."

As Baucon explored the rest of the codex, he found further clues that da Vinci was thinking about trace fossils. When da Vinci wrote about the bagful of corals that the peasants had brought him, he used the adjective "*tarlati*", derived from the Italian word for "woodworm", to describe the holes that permeate the coral's skeleton. That suggests he knew the holes had been created by living creatures, says Baucon. You can also find descriptions which suggest that like modern scientists, da Vinci used observations of living animals to decipher the fossilised marks. For example, in notes preceding the comment about worm traces in the rock, da Vinci describes a species of mollusc that "does not swim, but makes a furrow in the sand and proceeds along the furrow's edges".

These findings alone were unique for his time, and not matched until at least the 19th century, says Baucon. But da Vinci went further. The *Codex Leicester* shows that da Vinci's interpretation of trace fossils was crucial in enabling him to prove his ideas about the nature of fossilised shells and the sedimentary origin of the rocks that held them.

The burrows left by worm-like organisms feeding between layers of mud, for example, proved that the rocky mountain top was once a soft sea bottom, providing compelling evidence against the flood theory. And the presence of worm holes bored into the shells and corals helped to dismiss the inorganic theory. The fossils were clearly biological, da Vinci said, "because there remains a trace of the [animal's] movements in the shell which [it] consumed in the same manner as a woodworm in wood."

"Leonardo understood that these borings were the result of past biological activity," says Baucon. "He also recognised the biological interaction between the bored shell and the boring organism, at a time when scholars misinterpreted even fossil shells."

Although these ideas about fossil origins were distinctly modern, da Vinci used them as evidence to support a world view, inspired partly by ancient Greek philosophies, that would seem ludicrous by today's standards. Da Vinci's interest in fossils stemmed from his theory that the human body was a microcosm of the Earth (the macrocosm), and as such the two were unified on a metaphysical level and mirrored each other in form and function. He described it as follows in the *Codex Leicester*: "We might say that the earth has a spirit of growth, and its flesh is the soil, its bones the arrangement and connection of the rocks of which the mountains are composed, its cartilage the tufa [porous rock], and its blood the springs of the water."

To prove his point, da Vinci wished to show that earth and water circulate around the planet in the same way that he believed liquids and nutrients move around the body - hence his conviction that sediment on the soft seabed could eventually end up on top of mountains.

Neither the fossil studies nor the microcosm-macrocosm theory had the slightest impact on da Vinci's contemporaries, however. Da Vinci rarely published his findings, and with his revolutionary insights hidden away in his notebooks, both the inorganic and flood theories retained currency until the end of the 18th century, when they were gradually discarded in favour of the modern view.

Sketching wormholes

The findings have impressed Adrienne Mayor of Stanford University, California, a historian of science and folklorist who has studied interpretations of fossils in "pre-scientific" cultures. She describes Baucon's paper as "wonderful". "I had no idea that Leonardo could also put this in his honours," she says. Mayor notes that although the ancient Greeks had already correctly interpreted body fossils as the remains of ancient creatures, da Vinci was probably the first person ever to draw on trace fossils such as worm tracks and furrows to understand the fossilisation process. "That is revolutionary, very convincing," she says. "We can say that Leonardo is the father of ichnology."Da Vinci was probably the first person to draw on trace fossils to understand fossilisation

Domenico Laurenza, a Renaissance science specialist at the Galileo Museum in Florence, Italy, who has been commissioned by Gates to produce a new translation of the *Codex Leicester*, is more cautious, particularly about lumping da Vinci's research in with more modern ichnological work. "Da Vinci's general conception is pre-Darwinian," he says. "That doesn't mean that his studies are less scientific than those by Darwin, they are just different."Da Vinci is most famous for his paintings and sketches, of course. Might his ideas about fossils have influenced these too? He often included geological features in his paintings, depicting sedimentary structures and weathering processes in elaborate detail. According to Martin Kemp, an expert in da Vinci's art based at the University of Oxford, the microcosm-macrocosm theory is represented in the *Mona Lisa*. The flowing waters in the background are echoed in the woman's figure, Kemp says, in the "delicate cascades of her hair" and the "little rivulets of drapery falling from her gathered neckline".

Could trace fossils have also been depicted in the great man's paintings? Baucon thinks so. He has identified two potential candidates. One is a pale undulating trace on the surface of a sedimentary rock layer in the *Virgin of the Rocks*. The other is the presence of several winding lines on a rock layer in the *Madonna of the Yarnwinder*.

Kemp is sceptical. He says that the traces in the Madonna were originally red-coloured, and simply represent threads of yarn. Although he doesn't rule out the *Virgin* example, he says he would need to study the painting under magnification in order to check Baucon's theory.

But there is one other depiction that seems almost certain to be the first known illustration of a trace fossil: a roughly drawn honeycomb structure in another of da Vinci's notebooks, *Codex I*. This mysterious pattern is sketched on a page without any caption, alongside a series of images of body fossils. Baucon believes that it represents *Palaeodictyon*, one of the most common and characteristic trace fossils of the Apennine foredeep deposits.

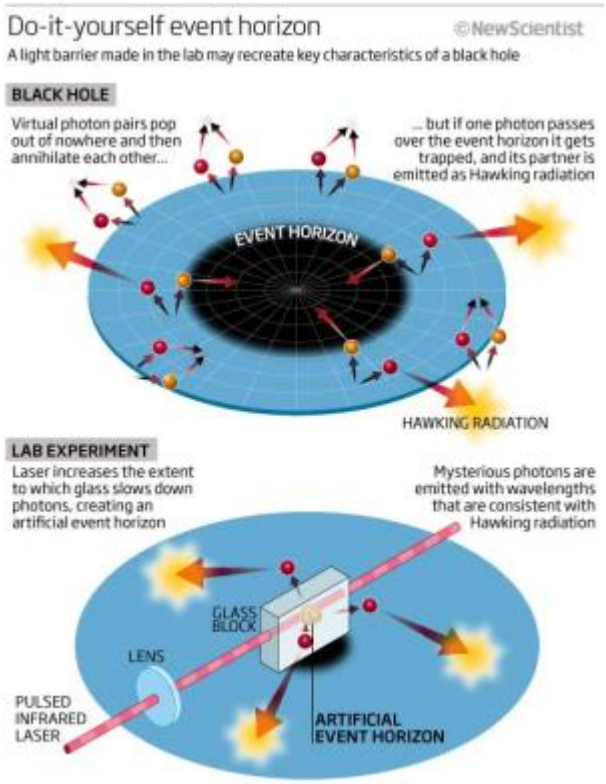
This hexagonal fossil (pictured above) is thought to be a burrow system that allows its inhabitant to farm bacteria, but the creator of this crafty den is unknown. Researchers even sent the deep-sea submersible Alvin to locate modern-day versions of the burrows at a vent system 3500 metres beneath the ocean surface, but no creatures were found inside.Scholars may argue over whether da Vinci deserves to be called the first ichnologist. But in drawing *Palaeodictyon*, he set a puzzle that today's ichnologists would still love to solve.

Jo Marchant is a consultant for New Scientist based in London and the author of Decoding the Heavens: Solving the mystery of the world's first computer

http://www.newscientist.com/article/mg20827801.400-fossil-secrets-of-the-da-vinci-codex.html?full=true&print=true

Hawking radiation glimpsed in artificial black hole

- 13:28 28 September 2010 by **David Shiga**



Do-it-yourself event horizon

You might expect black holes to be, well, black, but several decades ago Stephen Hawking calculated that they should emit light. Now, for the first time, physicists claim that they have observed this weird glow in the lab.

"Their experiment is the very first observation of Hawking radiation," says Ulf Leonhardt of the University of St Andrew's, UK. He was not involved in the work but led a team that created an "analogue" black hole using laser pulses in 2008 (*Science*, DOI: 10.1126/science.1153625). "Hawking radiation is not a mere theoretical dream, but something real," he says.

Others are not yet convinced of the team's evidence, or argue that Hawking radiation cannot come from anything other than a real black hole. If further experiments confirm that the new measurements, made at Insubria University in Como, Italy, are a form of Hawking radiation, however, it could open a new window into some of the most exotic objects in the universe. The finding also suggests that the bizarre physics once thought unique to black holes is much more widespread.

A black hole is an incredibly dense concentration of mass with an extreme gravitational field around it. Black holes earned their moniker because inside a certain radius, known as the event horizon, nothing escapes – not even light.

Uncertainty principle

Or so it seemed. Then in 1974 Hawking showed that, according to quantum theory, black holes should emit radiation after all. This is a consequence of the uncertainty principle, which says we can never be sure that an apparent vacuum is truly empty and, instead, that virtual particles are constantly appearing in pairs. These couples, made of a particle and its antimatter counterpart, rapidly annihilate and vanish again, so normally go unnoticed.

However, if a pair of photons pops up right at the event horizon, they may find themselves on different sides, with one flying free outside and the other trapped forever within. This prevents them from merging and vanishing, so the outside photon is effectively emitted by the black hole (see diagram, above right).

Hawking predicted black holes should give off a steady stream of such radiation – and many scientists assume he is right. The problem is that no one has ever actually seen it.

Escape velocity

In recent years, physicists have been toying with laboratory experiments that imitate the physics of an event horizon. This marks the point where escape from a black hole is impossible because the velocity required exceeds the speed of light, the cosmic speed limit.

Analogue black holes have a similar point that cannot be crossed because the speed required is too great. Unlike in a real black hole however, this "horizon" is not created by intense gravity, since we do not know how to synthesise a black hole, but by some other mechanism – utilising sound or light waves, for example. However, no one had seen photons resembling Hawking radiation emerging from these analogues, until now.

To create their lab-scale event horizon, Daniele Faccio of Heriot-Watt University in Edinburgh, UK, Francesco Belgiorno of the University of Milan, Italy, and their colleagues focused ultrashort pulses of infrared laser light at a wavelength of 1055 nanometres into a piece of glass. The extremely high intensity of these pulses – trillions of times that of sunlight – temporarily skews the properties of the glass. In particular, it boosts the glass's refractive index, the extent to which the glass slows down light travelling through it.

The result is a moving point of very high refractive index, equivalent to a physical hill, which acts as a horizon. Photons entering the glass behind this "hill", including ones that are part of a virtual pair, slow as they climb the hill and are unable to pass through it. Relative to the slow-moving pulse, they have come to a stop and remain behind the pulse until it has passed through the glass's length.

Mysterious photons

To see if this lab-made event horizon was producing any Hawking radiation, the researchers placed a light detector next to the glass, perpendicular to the laser beam to avoid being swamped by its light. Some of the photons they detected were due to the infrared laser interacting with defects in the glass: this generates light at known wavelengths, for example between 600 and 700 nanometres.

But mysterious, "extra" photons also showed up at wavelengths of between 850 and 900 nanometres in some runs, and around 300 nanometres in others, depending on the exact amount of energy that the laser pulse was carrying. Because this relationship between the wavelength observed and pulse energy fits nicely with theoretical calculations based on separating pairs of virtual photons, Faccio's team concludes that the extra photons must be Hawking radiation (*Physical Review Letters*, in press).

Not everyone is ready to agree. Adam Helfer at the University of Missouri in Columbia says the term Hawking radiation is best reserved for actual black holes with gravitational fields. "There is a parallel between them to a certain extent, [but] the laboratory experiments, interesting as they are, do not really bear on the very deep problems which are special to black holes." These revolve around how to fully marry gravity and quantum mechanics when describing these objects.

Quantum entanglement

In future, Ted Jacobson at the University of Maryland in College Park suggests testing for a key characteristic of Hawking radiation – whether the pairs of photons separated by the horizon are quantum entangled. Faccio says that using an optical fibre, as Leonhardt and colleagues did in 2008, rather than a glass block, might allow photon pairs separated by a laser horizon to be analysed for entanglement.

Meanwhile, Hawking radiation is also popping up in other, less direct black hole imitators. A team led by Silke Weinfurtner at the University of British Columbia in Vancouver, Canada, announced in August that they had observed a water-wave version of Hawking radiation in an experiment involving waves slowed to a halt to form a horizon (arxiv.org/abs/1008.1911).

Hawking radiation is turning out to be "a general phenomenon that occurs whenever you have a horizon of any sort", says Matt Visser of Victoria University of Wellington, New Zealand, who was not involved in either of the experiments.

He is not the only one intrigued by the indication that the sequence of events leading to Hawking radiation arises in analogue horizons, as well as real black holes. "The line of reasoning is more generic than it might at first seem, giving more faith that it may also be right for black holes," says Bill Unruh, who collaborated with Weinfurtner on the water-wave experiment and is known for the "Unruh effect", a predicted phenomenon that is similar to Hawking radiation but occurs outside a black hole.

"All the pieces of the puzzle seem to have suddenly fallen together at the same time," says Faccio. "This is all very exciting."

http://www.newscientist.com/article/dn19508-hawking-radiation-glimpsed-in-artificial-black-hole.html

Countdown to oblivion: Why time itself could end

- 20:31 28 September 2010 by **Rachel Courtland**, Cambridge, Massachusetts

The final countdown (Image: Nicemonkey/Alamy)

"We could run into the end of time," Ben Freivogel tells a seminar at the Massachusetts Institute of Technology in Cambridge. Several colleagues seem nonplussed, and one Nobel laureate looks downright exasperated. "I'm aware that this sounds like a crazy conclusion," Freivogel admits, generating a round of what sounds like relieved laughter. But perhaps their relief is short-lived.

The nature of time, our perception of it and even whether it exists at all are hot topics for both physicists and philosophers. But Freivogel isn't pushing a strange new concept of time.

His idea is arguably even more baffling. He thinks that time, as described by Einstein's theory of general relativity, could simply end in our universe, taking us with it. He gives us another 5 billion years or so before the axe falls (see "Five billion years to go", below).

This unsettling idea arises from a popular theory called eternal inflation. In this theory, different parts of space can undergo dramatic growth spurts, essentially ballooning into separate universes with their own physical properties. The process happens an infinite number of times, creating an infinite number of universes, called the multiverse.

Measure problem

The infinities involved mean that anything that can happen does happen – an infinite number of times. That makes it difficult to figure out how common a universe like ours is. "It sort of pulls the rug out from underneath your intuition of how to define probabilities," says Freivogel's colleague Raphael Bousso of the University of California, Berkeley.

To get around this problem, physicists take a "cut-off" of the multiverse, cutting out a finite patch of space-time and counting the universes within it to get a representative sample.

However, doing this inevitably slices through individual universes on the edge of the sample. This leads to incorrect probabilities of experimental outcomes in the multiverse – unless, Freivogel and his team argue, the mathematical cut-offs somehow have real and dire consequences for the places they intersect. Time would end there, they say, causing everything present to disappear. "The world, including you, would just cease to exist," says Bousso.

Predictive power

The idea is more than strange, not least because it is not clear how these mathematical constructs could impinge on the real world.

But the team say the cut-offs have to be considered real if they are to be used to calculate probabilities in the multiverse. These are key to making cosmological predictions about properties in our own universe such as the strength of dark energy.

The alternative, they say, is that applying cut-offs is simply not the right way to calculate probabilities in eternal inflation. "We're stuck between a rock and a hard place," says Bousso. "If you don't like the cut-off, then you have no way of making predictions and deciding what's probable in eternal inflation."

Ken Olum of Tufts University in Medford, Massachusetts, who was not involved in the work, agrees that there is a problem. "The whole issue is one that needs resolution," he says. "If we don't take the cut-off seriously, then we better figure out how to do calculations that are consistent with each other."

The trouble began last year, with a thought experiment raised over breakfast at a conference by Alan Guth of MIT and Vitaly Vanchurin of Stanford University in California. They imagined a scenario in which someone flips a coin and sets an alarm depending on the outcome. Heads and the alarm is set to wake you up after 1 minute, tails and you get 1 billion years' sleep. Before going to sleep, the chance of waking up in 1 minute or 1 billion years is 50:50.

Changing odds

Now imagine that the experiment happens in an infinite number of universes. If a cut-off is taken to study a subset of these universes, far more people in that subset – wherever the cut-off is made – will have woken up after a short nap than a long one. So the odds are no longer 50:50.

How can the probability change once you get up? The team argue that the only way to make sense of the changing odds is if the cut-off is physical. If the cut-off is real, then many of the people who got tails – and went to sleep for 1 billion years – would hit the end of time before their alarm could go off (arxiv.org/abs/1009.4698).

"If we do have the end of time, then that's a strange situation, but at least it solves this paradox," says Olum.

The radical idea "certainly is one way to resolve the paradox", says Guth. But he adds that it is hard to lend much credence to the suggestion, since it is far from clear what physical mechanism could cause time to vanish.

No physical meaning

Instead, Guth suggests the paradox could just be an artefact of the measurement technique, since the exponential nature of eternal inflation means that newer universes will always be more common than older ones.

He suspects cut-offs have no physical meaning: people who don't wake up before the cut-off will still wake up, just after it. The cut-off "is the end of the data set. It doesn't necessarily mean it's the end of the world."

However, Bousso says we have to take the cut-off seriously, since it's the only good way physicists have of calculating probabilities. "In current approaches to understanding eternal inflation, the cut-off and only the cut-off defines what is possible, likely, unlikely and impossible," he says.

For the moment, Guth says he is comfortable with not fully understanding how probabilities work in eternal inflation. "We are dealing with something that's exponentially expanding and expanding forever," he says. "It is conceivable that will introduce new problems that ordinary actuaries have never encountered."

Five billion years to go

To calculate probabilities in the infinite multiverse, physicists have devised "geometric cut-offs", ways of slicing off finite samples of space-time. This lets them count finite numbers of events and extrapolate out to the whole multiverse by taking larger and larger samples.

But doing this inevitably slices through some universes that lie on the edge of whatever cut-off is used, a process that Ben Freivogel at MIT and colleagues say could end time there (see main story).

So could this happen to our universe? Sadly, yes. They say several methods of taking cut-offs suggest a universe the same age as ours, 13.7 billion years old, is likely to reach the end of time in 5 billion years or so.

"The point is that the way people treat eternal inflation, time can end, no matter whether we understand precisely how time would actually do that," says team member Raphael Bousso of the University of California, Berkeley.

"Is there a way of thinking about the end of time that makes it seem less weird?" he asks.

One of the cut-off methods offers a way to visualise the process. It slices the multiverse by taking a single "causal patch" – a region of space beyond which light has not had time to reach since that region's big bang. From this viewpoint, you can think of our 5-billion-year expiration date as the average time needed for a galaxy located anywhere inside our 13.7-billion-light-year causal patch to reach the edge of the region.

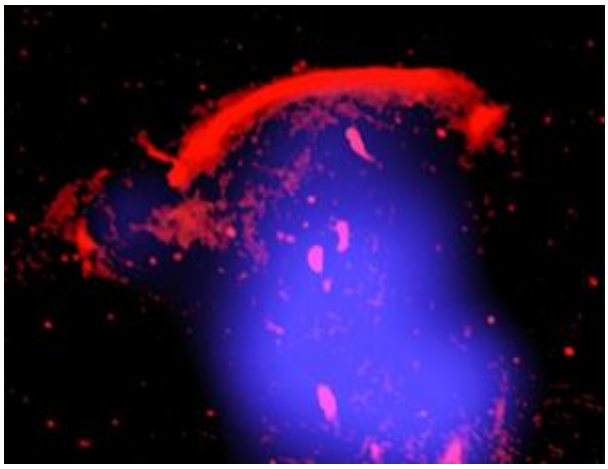
What would it mean for time to end in this way? The team speculate that reaching the edge of a causal patch might be like encountering the event horizon of a black hole, the boundary beyond which nothing that falls in can escape.

So just as someone watching an object fall into a black hole will see the object burn up, someone inside a given universe might see an object hitting the edge of the cut-off – where time ends – incinerate on contact.

http://www.newscientist.com/article/dn19513-countdown-to-oblivion-why-time-itself-could-end.html

Crashing galaxy clusters may turbocharge cosmic rays

- 12:56 27 September 2010 by **Stephen Battersby**



A bright arc (red) reveals radio emission at the shockwave created when two galaxy clusters collided. Hot cluster gas glows in X-rays (blue) (Image: R J van Weeren/Leiden)

The biggest collisions in the cosmos seem to be acting as giant particle accelerators, generating some of the mysterious "ultra-high energy" cosmic rays that slam into Earth.

Collisions between clusters of galaxies should produce shockwaves whose magnetic fields can boost loose protons and electrons up to very high energies, but until now there was no clear evidence of it happening.

Now, researchers led by Reinout van Weeren of Leiden University in the Netherlands have used radio telescopes in the Netherlands, India and the US to image a huge bright arc at the interface of two colliding galaxy clusters, known collectively as CIZA J2242.8+5301. The energy spectrum of the radio waves changes across the arc in a way that fits models of shock acceleration.

The shockwave stretches for more than 6 million light years, and van Weeren calculates that it could easily accelerate protons to energies of up to 10^{19} eV. That is millions of times as high as the particles in any atom smasher and in the energy range of mysterious charged particles called ultra-high energy cosmic rays that occasionally hit Earth's atmosphere.

A few of the protons hitting our atmosphere may even have come all the way from CIZA J2242.8+5301, 3 billion light years away.

Active galaxies

At even higher energies, protons can only travel about 160 million light years before being destroyed in collisions with low-energy photons that permeate space, radiation known as the cosmic microwave background.

No known cluster shock is that close to us, so the most extreme cosmic rays – which can reach energies of 10^{21} eV – must have another source – probably active galaxies whose black holes are violently devouring matter, or gamma-ray bursts, explosions thought to herald the birth of black holes.

"The case for shock acceleration in this object seems compelling," says Charles Dermer of the Naval Research Laboratory in Maryland, who was not involved in the study. But he believes that active galaxies are a better bet for producing the ultra-high energy cosmic rays that zap Earth, as they can account for a much wider energy range of these particles.

Journal reference: *Science* (DOI: 10.1126/science.1194293)

http://www.newscientist.com/article/dn19500-crashing-galaxy-clusters-may-turbocharge-cosmic-rays.html

Out-of-this-world proposal for solar wind power

- 14:00 24 September 2010 by **Charles Choi**

Forget wind power or conventional solar power, the world's energy needs could be met 100 billion times over using a satellite to harness the solar wind and beam the energy to Earth – though focussing the beam could be tricky.The concept for the so-called Dyson-Harrop satellite begins with a long metal wire loop pointed at the sun. This wire is charged to generate a cylindrical magnetic field that snags the electrons that make up half the solar wind. These electrons get funnelled into a metal spherical receiver to produce a current, which generates the wire's magnetic field – making the system self-sustaining.

Any current not needed for the magnetic field powers an infrared laser trained on satellite dishes back on Earth, designed to collect the energy. Air is transparent to infrared so Earth's atmosphere won't suck up energy from the beam before it reaches the ground.Back on the satellite, the current has been drained of its electrical energy by the laser – the electrons fall onto a ring-shaped sail, where incoming sunlight can re-energise them enough to keep the satellite in orbit around the sun.

A relatively small Dyson-Harrop satellite using a 1-centimetre-wide copper wire 300 metres long, a receiver 2 metres wide and a sail 10 metres in diameter, sitting at roughly the same distance from the sun as the Earth, could generate 1.7 megawatts of power – enough for about 1000 family homes in the US.A satellite with the same-sized receiver at the same distance from the sun but with a 1-kilometre-long wire and a sail 8400 kilometres wide could generate roughly 1 billion billion gigawatts (10^{27} watts) of power, "which is actually 100 billion times the power humanity currently requires", says researcher Brooks Harrop, a physicist at Washington State University in Pullman who designed the satellite.

Since the satellites are made up mostly of copper, they would be relatively easy to construct. "This satellite is actually something that we can build, using modern technology and delivery methods," Harrop says.Satellites laden with solar panels that can beam their energy down 24 hours a day have been discussed for decades. California agreed last December to a deal involving the sale of space-based solar power. Solar panels cost more per pound than the copper making up the Dyson-Harrop satellites, so according to Harrop, "the cost of a solar wind power satellite project should be lower than a comparative solar panel project".So far so good, but there is one major drawback. To draw significant amounts of power Dyson-Harrop satellites rely on the constant solar wind found high above the ecliptic – the plane defined by the Earth's orbit around the sun. Consequently, the satellite would lie tens of millions of kilometres from the Earth. Over those distances, even a sharp laser beam would spread to thousands of kilometres wide by the time it reached Earth."Two megawatts spread across areas that large are meaningless, less than moonlight," says John Mankins, president of consultancy firm Artemis Innovation which specialises in space solar power. To beam power from a Dyson-Harrop satellite to Earth, one "would require stupendously huge optics, such as a virtually perfect lens between maybe 10 to 100 kilometres across," he says.He also points out that the wire could burn out due to the huge current coursing through it, although he has not performed the calculations to gauge the probability of that occurring. But he does say that a smaller version of this "clever and interesting" satellite could help power some space missions. "I could imagine uses for this idea outside of the plane of the ecliptic, such as helping generate power for something like the Ulysses spacecraft, which went around the poles of the sun."

Journal reference: *International Journal of Astrobiology*, DOI: 10.1017/S1473550410000066

http://www.newscientist.com/article/dn19497-outofthisworld-proposal-for-solar-wind-power.html

Solved: mystery of the meteor-shedding asteroid

- 24 September 2010

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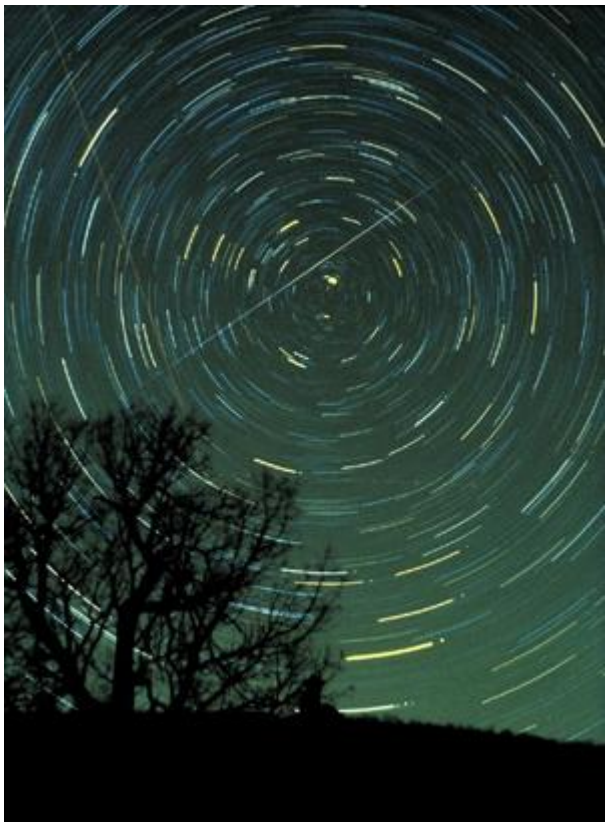


Strange source of shooting stars (Image: Jimmy Westlake/Colorado Mountain College)

AN ASTEROID that is the source of an annual meteor shower may owe its weird crumbliness to intense cooking by the sun.

Most meteor showers are thought to come from comets, whose icy surfaces vaporise easily during close encounters with the sun. Dust that is liberated in the process burns up in Earth's atmosphere, creating "shooting stars".

However, the debris stream responsible for the annual Geminid shower in December follows the orbit of a 5-kilometre-wide object called 3200 Phaethon, which appears to be an asteroid.

So how does the rocky body cast off so much material without any ice to vaporise? A clue came in June 2009, when NASA's STEREO-A spacecraft watched the asteroid double in brightness at its closest point to the sun, which lies just 14 per cent of Earth's distance from the star.

Now David Jewitt and Jing Li, both at the University of California, Los Angeles, say the asteroid's sunward face should have reached a searing 480 to 780 °C at that point. That is hot enough to make its rocks expand and crack, generating dust that reflected sunlight and caused the asteroid to brighten (*The Astronomical Journal*, in press).

A second effect might also contribute to Phaethon's shedding. Although the asteroid appears to be devoid of ice, some water molecules may be chemically bound within some of its rocks. If a mineral called serpentinite is present, for example, it would break down at 630 °C and release its chemically bound water as vapour.

The process can be violent, according to a 2009 experiment by Jay Melosh of Purdue University in West Lafayette, Indiana, and colleagues. "The fragments of serpentinite actually popped off the surface at high speed, presumably driven by steam exploding from the dehydrating minerals," Melosh says.

The breakdown of minerals like serpentinite could cause the asteroid to shed debris, he says.

"Witnessing mass loss from Phaethon is a great advance," adds Yan Fernández of the University of Central Florida in Orlando, who has studied Phaethon but was not involved in the new study. "It'll be great if someone can find more of these outburst events."

http://www.newscientist.com/article/mg20727794.100-solved-mystery-of-the-meteorshedding-asteroid.html

How to be happy (but not too much)

- 28 September 2010 by **Dan Jones**

Magazine issue 2779.

Positive feelings change the way our brain works (Image: Shutterstock

It's good for your health, it makes you smarter – and our brains are hard-wired for it. ***New Scientist*** *counts our reasons to be cheerful*

DOOM and gloom are the order of the day across most of the western world. Economies are faltering, the cost of living is going up and many people's real income is falling. For some, unemployment is a reality now or in the near future. If the pursuit of happiness is supposed to be one of our goals, prospects appear bleak.

Take a closer look, and it isn't that simple. In fact, economic hard times have little impact on how happy most people feel. Indeed, it would appear that we humans are built to experience happiness, and understanding why is helping us work out what enhances our feelings of well-being. It even points to ways we can adapt to cope with the hardships the recession may bring, and keep smiling whatever happens.

One thing that is clear is that once life's basics are paid for, the power of money to bring happiness is limited. In fact, it can be positively harmful to our sense of well-being. Jordi Quoidbach of the University of Liège, Belgium, and colleagues recently asked a group of people to taste a piece of chocolate in their laboratory. They found that the wealthier members of the group spent less time savouring the experience, and reported enjoying the chocolate less than the subjects who weren't so well off. The same was also true of one group in a separate experiment. This time, half the people had been primed with images of money before they tasted the chocolate. These participants enjoyed the tasting less than a group who had not seen the images, suggesting that just the thought of money is enough to stem our enjoyment of life's simple pleasures (*Psychological Science*, vol 21, p 759).

So just what is it that makes us happy? Happiness can take the form of many different positive emotions (See "Happiness is..."), and some hints of what makes us happy may come from work that questions why these

emotions first evolved. The answer isn't as obvious as it is in the case of negative emotions. These are clearly beneficial in the rough and tumble of survival: anger readies us to fight an opponent, fear makes us run away from danger, and disgust steers us away from contaminated foods and other sources of infection. Although there is no shortage of evidence that feelings of pleasure - obtained by finding a tasty meal or a sexy mate, for example - are important in rewarding and consolidating beneficial behaviours, it is harder to explain how the more diffuse positive emotions such as awe, hope or gratitude evolved.

This troubled psychologist Barbara Fredrickson of the University of North Carolina at Chapel Hill, so she started looking for evolutionary benefits that pleasure might confer. "I thought there must be more to it than this," she recalls.

Fredrickson's "broaden and build" theory proposes that happiness and similar positive states of mind improve our cognitive capacities while we are in safe situations, allowing us to build resources around us for the long term. That's in marked contrast to the effects of negative emotions like fear, which focus our attention so we can deal with short-term problems. "Positive feelings change the way our brains work and expand the boundaries of experience, allowing us to take in more information and see the big picture," Fredrickson argues.

Positive feelings change the way our brains work, allowing us to take in more information

Since she proposed it in 1998 in the *Review of General Psychology* (vol 2, p 300), her theory has gathered a wealth of experimental support. Eye-tracking and brain-imaging experiments, for example, have revealed that positive moods increase and broaden the scope of visual attention, helping the brain gather more information.

A happy solution

Feeling good has also been shown to improve people's creativity and ability to solve problems. In one experiment, subjects were shown a video of comedy bloopers to lighten their mood, before being presented with a practical problem involving a box of matches, a box of tacks and a candle. They were told to attach the candle to a pinboard in such a way that wax didn't drip on the floor (the solution is to use the matchbox as a plinth for the candle). The experimenters found that people who had viewed the comedy clips were more likely to solve the problem than controls who saw a mathematics documentary intended to put them in a more neutral mood (*Journal of Personality and Social Psychology*, vol 52, p 1122).

Other experiments have found that a good mood improves people's verbal reasoning skills (*Proceedings of the National Academy of Sciences*, vol 104, p 383). And various studies have shown that when people are in a good mood, their social skills improve: they become more gregarious and trusting of others, and deal more constructively with criticism.

These changes concern the "broaden" part of Fredrickson's hypothesis. The "build" part predicts that we learn from the cognitive benefits of fleeting positive emotions, and so develop a more lasting positive state of mind. "As positive emotions compound, people actually change for the better," she says.

Fredrickson found initial, though tentative, empirical support for this idea in 2001 with studies of the same group of healthy students before and after the 11 September attacks on the US. The subjects who reported more positive emotions before the attacks also had fewer depressive symptoms after the attacks. Looking more closely, she found that although they also felt the same kind of grief as their peers, these students coped by feeling positive emotions such as gratitude for the safety of their friends and awe at the bravery of firefighters rescuing survivors. Although not conclusive, the results supported the idea that cultivating a

positive mindset in good times helps us learn mechanisms that enable us to feel better in bad times, which is in line with the broaden-and-build theory (*Journal of Personality and Social Psychology*, vol 84, p 365).

More recently, she trained a group of adults in a form of meditation that encouraged them to think positively about someone they loved, and then to extend those feelings to people they might not feel so close to. After seven weeks of practising the technique for a few minutes each day, the participants scored higher on a range of positive emotions - not just increased affection for their loved ones. Overall, the participants reported greater joy, hope, gratitude, pride, interest and awe. They also experienced better relationships with others. Importantly, these changes carried over to days on which the subjects didn't meditate. These benefits depended on the amount of time people spent meditating, and, as the broaden and build theory would have predicted, they amplified as the study progressed, suggesting that the temporary positive experiences were building on one another and leading to more lasting changes in their brains (*Journal of Personality and Social Psychology,* vol 95, p 1045). Other studies using different forms of meditation - including "mindfulness", which involves cultivating calm awareness of bodily sensations and thoughts - have also shown that they promote temporary positive emotions (*Annals of Behavioral Medicine*, vol 35, p 331), though it's not so clear whether these would build up over time to provide more lasting changes.

As philosophers have long pointed out, immediate pleasures and a positive mood are not to be confused with what the Greeks called eudaimonia, the deeper level of happiness associated with a flourishing and contented life. Yet Fredrickson's work shows a clear connection between the two. "Positive emotions give us more tools to handle life's ups and downs, and that's what makes life more satisfying and us happier," she says.

From this, you might conclude that the happier we are, the better we will be at tackling the tasks facing us - but that's true only up to a point. Joe Forgas at the University of New South Wales in Sydney, Australia, has shown that positive moods can make us more gullible, less able to develop persuasive arguments, and more likely to make careless decisions. This has led Robert Cummins of Deakin University in Melbourne, Australia, among others, to argue that there is an optimum level of life satisfaction - around 7 or 8 out of 10 on the standard scale - at which we flourish. And indeed, this is the average level of happiness found in the majority of western countries (see map), where most people live fairly comfortable, safe lives.

Cummins thinks that this happiness level may have been selected for during evolution. Numerous studies have found that our happiness is pre-programmed to a certain extent, with genetic differences accounting for about 50 per cent of the variation between people. If happiness is controlled by our genes, the idea that natural selection might have pushed the population as a whole towards a certain level of happiness would certainly be plausible. "As long as people can maintain a normal lifestyle, they will experience that level of happiness," says Cummins.

Genetic differences account for about half of the variation in happiness between people

Recession not depression

Does this tell us anything about how people will fare in a recession? Studies of previous economic crises lend support to Cummins's view. Ruut Veenhoven, emeritus professor of social conditions for human happiness at Erasmus University in Rotterdam, the Netherlands, examined the global recession of the early 1980s to see how changing economic fortunes affected the well-being of affluent western societies. "We found essentially no effect whatsoever," he says. Life satisfaction dipped only slightly in the year following the recession, and sales of tranquillisers and rates of diagnosed depression remained steady. "I see no reason to expect this crisis to be any different - unless it gets really bad."

What about the impact on those dealt the heaviest blows? Someone who loses their job and their income could be forgiven for not feeling great about their life. Fredrickson suggests that her findings could help people bolster their emotional defences against such troubles. Pursuing small, momentary pleasures should help to build resilience to stressful events, she says.

That still leaves us a long way from a detailed road map to happiness, but Leslie Kirby of Vanderbilt University in Nashville, Tennessee, is trying to plot a little more of the route. She has already found that different positive emotions broaden, build and buffer in different ways: feelings of joy tend to make people calmer and less easily upset by any negative events they later encounter, whereas a sense of gratitude makes people feel more in control and encourages a proactive attitude towards dealing with such events, Kirby says. She is now investigating whether particular positive emotions are more effective than others at bolstering a general feeling of well-being in hard times.

Fredrickson's techniques won't work for everybody. For example, Weiting Ng and Ed Diener of the University of Illinois at Urbana-Champaign investigated how people with different personality types responded to coping strategies that involve reinterpreting negative events to see positive aspects, and thinking about how to change the situation or learn from it. This showed that while these techniques worked well in people low in neuroticism, they were of little benefit to highly neurotic people (*Journal of Research in Personality*, vol 43, p 455).

So which strategy will work for you? Fredrickson recommends trying out several different ones and concentrating on those that feel right. And don't expect an instant effect. Jonathan Haidt, a psychologist at the University of Virginia in Charlottesville, says that as with any new skill, mastering these techniques takes practice. A lot of concentration and conscious effort are needed at first, but over time the skills become habitual and reflexive. If a happier future appeals, why not give it a go?

Mood boosters

- Write a diary. Simply writing about a positive experience has been shown to increase people's life satisfaction, with the benefits lingering for two weeks after the task (*Journal of Clinical Psychology*, vol 62, p 1291). A further study found that a group of subjects who wrote about their emotions for just 2 minutes a day, over two days, reported fewer physical health complaints four weeks down the line (*British Journal of Health Psychology*, vol 13, p 9).
- Dispute negative thinking. This is a technique borrowed from cognitive behavioural therapy, in which you catch negative thoughts as they arise and ask: "Is there really reason to think like this? Can I reframe this in a more positive way?"
- Meditate. Barbara Fredrickson and colleagues have shown that meditation can relax both your body and your mind, with many beneficial effects for well-being and happiness (*Journal of Personality and Social Psychology*, vol 95, p 1045). It's not easy, however, and you may need some training before you get going.
- Nurture meaningful relationships with family and friends. More than simply improving your well-being, it might just save your life. "Social resources and ties to groups are one of the key buffers protecting us against unhappiness," says Fredrickson. A recent meta-analysis of 148 studies on links between the quantity and quality of social relationships and mortality suggests that being socially isolated is about as bad for your health as smoking or drinking excessively, and worse than being obese (*PLoS Medicine*, vol 7, p e10000316).
- Beware consumerism. Buying more possessions won't make you as happy as spending money on social activities or new and exciting experiences (*The Journal of Positive Psychology*, vol 4, p 511).

Happiness is...

Happiness, in its everyday sense, is akin to pleasure or joy, something we experience in the moment as a result of enjoyable activities. Besides pleasure, there are of course many different positive emotions, such as awe, pride, and gratitude that might also contribute to our general mood.

When psychologists talk about happiness, however, they usually use the term to mean our overall and long-term subjective well-being and life satisfaction. Happiness in this broader sense is mostly probed with questionnaires that ask subjects to rate how much they agree or disagree with statements such as "In most ways my life is close to ideal," or "If I could live my life over, I would change almost nothing." When averaged over a group such as a nation, these measures can be used to generate a measure of collective happiness. Importantly, recent psychological research is explaining how those fleeting positive emotions contribute to this longer-lasting satisfaction and contentment with our life.

Dan Jones is a writer based in Brighton, UK. To assess your happiness, try Ed Diener's Satisfaction With Life Scale and the Subjective Happiness Scale devised by Sonja Lyubomirsky at the University of California, Riverside

http://www.newscientist.com/article/mg20727791.000-how-to-be-happy-but-not-too-much.html

Sparks fly over origin of altruism

- 29 September 2010 by **Michael Marshall**, Amsterdam

Magazine issue 2780.

For the good of the colony (Image: Bence Mate/naturepl.com

AN EXPECTANT silence has descended on the small room in the Royal Netherlands Academy of Arts and Sciences in Amsterdam. Alan Grafen, a theoretical biologist from the University of Oxford, is taking his time to set up his presentation. When he's ready, he denounces three of his colleagues as "unscholarly" and "transparently wrong", and wonders what could have led such "talented, honest biologists" to be so "misguided".

It's day one of a meeting on the evolution of conflict and cooperation, and exchanges are fierce. At stake is one of the pillars of modern evolutionary biology: the theory of inclusive fitness, which explains how altruistic behaviour can spread through a population. Altruism, in this context, refers to any behaviour which helps the chances of survival of others at the expense of the altruistic individual. Honeybees, which sting intruders to protect their hive and sign their own death warrant in the process, are a classic example.

The conference is the latest stage of a controversy that has been raging over the work of three Harvard University scientists: mathematical biologists Martin Nowak and Corina Tarnita, and social insect guru and father of sociobiology Edward O. Wilson. Last month, they published a paper in *Nature* attacking inclusive fitness (vol 466, p 1057).

The details of their attack are technical and mathematical, but the consequences could be far-reaching. They say inclusive fitness is irrelevant to the real world and want to replace it with a series of equations that could describe the evolution of cooperation in far more detail than ever before.

Their statements have infuriated many of their colleagues, including Grafen, who say their approach has just as many problems as inclusive fitness.

The story dates back to 1955, when British geneticist J. B. S. Haldane was asked if he would risk his life to save another. He supposedly replied that he would only do so to save at least two brothers or eight cousins, reasoning that this would preserve enough copies of his genes to justify his own death. This idea - that animals are more likely to show altruistic behaviour towards individuals they are related to - is called kin selection.

Haldane's colleague William Hamilton later drafted a mathematical description of the phenomenon, known as inclusive fitness, which assigns numerical values to the costs and benefits of an animal's actions. In theory, inclusive fitness makes it possible to calculate the extent of the spread of a given altruistic behaviour - such as staying with your parents to raise your siblings - through a population. Hamilton's maths has been used for

decades by biologists studying cooperation in animals and was a major inspiration for Richard Dawkins's *The Selfish Gene*.

The problem, say Nowak and Tarnita, is that the calculations just don't work in the real world because they rely on a limiting set of conditions that nature does not stick to. For example, they are only valid for interactions between pairs of animals, which is fine for solitary species whose individuals rarely meet, but no use in studying thousands of ants sharing a colony. What's more, they do not work for populations that are under strong pressure to evolve.

These and other limitations, Tarnita says, mean that the maths of inclusive fitness is not relevant to the real world. Instead, she says biologists should use the models of population genetics, which focus on interactions between different gene variants. These models avoid the messiness of predicting the consequences of behaviour and don't require any dubious assumptions.

Tarnita has shown that by using standard population genetics equations, it is possible to produce an all-encompassing model. In Amsterdam, she excitedly explained that when she plugged Hamilton's conditions into her model, its equations simplified to those of inclusive fitness. Hamilton's maths, she concludes, describes a special case of a broader model of how all behaviours evolve: it is not wrong, but limited.

The new model is all-encompassing, and represents a broader theory about behaviour

Nowak points out that, in thousands of insect species, daughters leave the nest despite being as closely related to each other as the workers in an ant colony. This suggests there is some factor other than kin selection keeping workers in the nest and driving altruistic behaviour.

Some biologists have embraced the new ideas: Michael Doebeli of the University of British Columbia in Vancouver, Canada calls them "a great step in the right direction". But according to Grafen and many others, they are nothing new. They say theoretical biologists have always known that inclusive fitness was an approximation, though this seems not to have filtered through to experimental biologists, who have tended to take it as gospel.

Some call Tarnita and Nowak's model a step in the right direction. To others, it is lunacy

What's more, in order to use Nowak and Tarnita's model to study the evolution of a behaviour, you would need to know an enormous amount about the genes involved - their identity, location and interactions.

"Lunacy!" cries Grafen. Even if you knew all of this, he says, it would only illuminate the process for one species. So it would be better to stick with inclusive fitness, rough and ready though it is, because it will enable biologists to make predictions about how various species should behave - and indeed already has. Many of his peers agree, arguing that inclusive fitness should still be used as a "rule of thumb".

The argument seems set to run and run. As *New Scientist* went to press, more than 140 leading biologists, including several who were present in Amsterdam, had signed a letter to *Nature* criticising Nowak's paper - though the journal would "neither confirm nor deny" that it had received the letter. Nowak seems to have been taken aback by the fuss, saying: "I didn't expect our work to be so controversial."

http://www.newscientist.com/article/mg20827804.100-sparks-fly-over-origin-of-altruism.html?full=true&print=true

Reports of miracle drugs are no substitute for trials

- 29 September 2010 by **Ian Roberts**

Magazine issue 2779.

No miracle cure (Image: ERproductions Ltd/Getty)

How did a collection of case reports lead to an untested drug being administered all over the world to people with serious bleeding, asks ***Ian Roberts***

IN 1999, a leading medical journal published a remarkable story of survival against the odds. A 19-year-old Israeli soldier was admitted to hospital with a gunshot wound to his chest. The bullet had ripped through a major blood vessel causing torrential internal bleeding. Surgical intervention had failed and he was close to death. But then, "in a desperate attempt to control the bleeding", he was given two intravenous doses of a drug called NovoSeven. Minutes later the bleeding stopped, allowing surgeons to repair the blood vessel. He survived (*The Lancet*, vol 354, p 1879).

Such stories can be enormously persuasive. Even though most doctors know they are an unreliable source of information about drug efficacy, a compelling medical story can burn itself onto a doctor's memory. Stories weave a simple yarn of causation between events, imposing order and banishing uncertainty. But in medicine, uncertainty is a reality that doctors have to work with.

NovoSeven, or recombinant factor VIIa, is a blood clotting agent used to treat haemophilia. It is not licensed for use in trauma patients. Yet this enormously expensive drug is now used in trauma rooms around the world, as well as by the US military to treat battlefield casualties.

How did this happen? To obtain a licence for the use of NovoSeven in trauma patients, manufacturer Novo Nordisk would have to carry out randomised controlled trials and present the results to drug regulators. The regulators insist on such trials because they are the best method we have of determining whether a treatment works.

A few small trials have been done, but as yet there is scant evidence that NovoSeven works in traumatic bleeding. A recent review of all the evidence, prepared by the Cochrane Collaboration, concludes that there is no reliable evidence that NovoSeven is effective in traumatic bleeding.

Nevertheless, stories like that of the Israeli soldier continue to circulate. Bearing in mind that about 600,000 people bleed to death in hospitals every year, it is no surprise that other doctors have been inspired to take similar desperate measures. Doctors are legally entitled to use drugs in such "off label" ways if they think it will help.

When the measures appear to work, doctors often tell the story as a case report in a medical journal - regardless of the fact that some of the patients would have survived anyway. In contrast, stories of patients who were given NovoSeven but died rarely see the light of day. Case reports have come to dominate the literature on NovoSeven, vastly outnumbering reports of randomised controlled trials.

When desperate measures work, doctors often tell the story as a case report in a journal

Some of these case reports are written by doctors who have a financial relationship with Novo Nordisk. For example, they may have been paid by the company as expert consultants.

Drug companies know that the credibility of any story depends on the authority and narrative ability of the storyteller, so they go to great lengths to find doctors who are willing to help them spread the word. One way they do this is to bring medical experts together to prepare guidelines on how to manage the condition for which the drug might be used.

For example, in 2005, a group of doctors convened to develop guidelines on the management of severe traumatic bleeding. Novo Nordisk paid for travel, hotel accommodation, meeting facilities, honoraria and the preparation of the guidelines. One of the recommendations in the guidelines was that NovoSeven should be considered if bleeding persists after standard treatment (*Critical Care*, vol 11, p R17).

By 2006, NovoSeven was being used in civilian trauma care around the world and also by both the British and American military to treat soldiers wounded in battle in Iraq and Afghanistan.

Then, in June 2008, Novo Nordisk announced that it had prematurely stopped its trial of NovoSeven for the treatment of bleeding in severe trauma. According to the company, this was because an interim analysis predicted "a low likelihood of obtaining a positive trial outcome". The results of the trial have yet to be published in a peer-reviewed journal, though the company has posted a synopsis on its website.

The synopsis shows that of 262 patients given NovoSeven, 12.2 per cent died. In contrast, 11.1 per cent of the 280 patients given a placebo died. This trial provides no new evidence that the drug is effective. The synopsis also noted that there was more unwanted clotting among people given NovoSeven. Unwanted clotting might increase the risk of heart attacks, stroke, clots in the lungs and thrombosis.

Until large randomised controlled trials have been completed, we cannot know whether NovoSeven does more good than harm in bleeding trauma patients. However, thanks to just such a trial funded by the UK government, of which I was chief investigator, we now have a safe and effective drug for severe bleeding in trauma: a cheap generic medicine called tranexamic acid (*The Lancet*, vol 376, p 23).

The British military has stopped using NovoSeven, and patience is wearing thin in the US. Earlier this year, *The Baltimore Sun* reported that federal investigators are exploring the US army's use of NovoSeven. About

the same time, at Novo Nordisk's request, the US Food and Drug Administration added a warning to the label pointing out the risk of clotting when it is administered outside its licensed uses.

The moral of this particular medical story is clear. In the absence of evidence from randomised controlled trials we should remain sceptical about drug efficacy. Medical stories may be compelling, but they do not always give us the full picture.

Ian Roberts is a professor of epidemiology and public health at the London School of Hygiene & Tropical Medicine. He was chief investigator of the tranexamic acid trial

http://www.newscientist.com/article/mg20727795.100-reports-of-miracle-drugs-are-no-substitute-for-trials.html

A fifth of all wild plant species face extinction

- 11:05 29 September 2010 by **Andy Coghlan**
- Magazine issue 2780.

Cycads need love too (Image: John Cancalos/Ardea)

They're not as photogenic as pandas, nor as captivating as tigers: among conservationists, plants have tended to attract rather less attention than animals. That could start to change with the publication this week of the first list of extinction risks for the world's plants.

The Sampled Red List Index for Plants indicates that 22 per cent of all wild plant species face extinction, comparable to the figure for mammals (21 per cent) and higher than that for birds (12 per cent). Of the threatened plant species, 63 per cent are found in tropical rainforest areas which could soon be cleared.

The aim is to provide a baseline for future assessments, and to put plants firmly on the conservation agenda.

"If all the plants vanish, so will all animals and birds," says Eimear Nic Lughadha of the Royal Botanic Gardens in Kew, London, who led the project. The UK Natural History Museum and the International Union for the Conservation of Nature were also involved.

What makes this list different from previous efforts is that it is based on scientifically defensible data, Lughadha says. Her team concluded that it was impossible to comprehensively evaluate the status and fate of all 380,000 known plant species, as has been done for the world's 10,000 bird species. So instead they decided to emulate the way existing Red List estimates of risks to birds, mammals and amphibians were compiled.

That meant investigating a sample of plant species chosen for their taxonomic and regional coverage. "We wanted to take a sample of plants that we could defend as being representative of plant diversity globally," says Lughadha.

Although they intended to study 7000 species, the team has decided to publish preliminary conclusions based on the 4000 species for which they have satisfactory data. The results are broken down into five broad groups of plants: monocots, including palms, orchids and grasses (with the major grain crops among them); bryophytes, including mosses and liverworts; pteridophytes, including ferns; gymnosperms, including conifers and cycads; and dicots, encompassing other plants.

Of these groups, the conifers and cycads are most threatened, with 36 per cent facing extinction.

"It's not a question of picking out ‘star' plants, but saying plants are integral to human and animal health," says Lughadha. "We do not know which plants underpin which particular ecosystems.

"At the moment we're throwing away species that we don't fully understand."

http://www.newscientist.com/article/dn19515-a-fifth-of-all-wild-plant-species-face-extinction.html

Beyond God and atheism: Why I am a 'possibilian'

- 27 September 2010 by **David Eagleman**
- Magazine issue 2779.

The origin of the cosmos still lies among the many mysteries facing humans (Image: N.Smith (University of California, Berkley) and NOAO/Aura/NSF)

When it comes to the big questions, why should we have to either deny God or believe? Surely good science doesn't so restrict us, says ***David Eagleman***

I HAVE devoted my life to scientific pursuit. After all, if we want to crack the mysteries of our existence, there may be no better approach than to directly study the blueprints. And science over the past 400 years has been tremendously successful. We have reached the moon, eradicated smallpox, built the internet, tripled lifespans, and increasingly tapped into those mind-blowing truths around us. We've found them to be deeper and more beautiful than anyone could have guessed.

But when we reach the end of the pier of everything we know, we find that it only takes us part of the way. Beyond that all we see is uncharted water. Past the end of the pier lies all the mystery about our deeply strange existence: the equivalence of mass and energy, dark matter, multiple spatial dimensions, how to build consciousness, and the big questions of meaning and existence.

I have no doubt that we will continue to add to the pier of knowledge, appending several new slats in each generation. But we have no guarantee how far we'll get. There may be some domains beyond the tools of science - perhaps temporarily, perhaps always. We also have to acknowledge that we won't answer many of the big questions in our brief twinkling of a 21st-century lifetime: even if science can determine the correct answer, we won't get to enjoy hearing it.

This situation calls for an openness in approaching the big questions of our existence. When there is a lack of meaningful data to weigh in on a problem, good scientists are comfortable holding many possibilities at once, rather than committing to a particular story over others. In light of this, I have found myself surprised by the amount of certainty out there.

Take, for example, this decade's books by the new atheists, such as Richard Dawkins, Daniel Dennett, Sam Harris and Christopher Hitchens. Their books are brilliant and insightful, but sometimes feed a widespread misconception that scientists don't have the capacity to gambol around beyond the available data. Some readers walk away from these books with the impression that scientists think they have the big picture solved - if not in detail, at least in outline.

But good science is always open-minded, and the history of science is one of surprises and overturnings. Science is nothing but careful thinking, and careful thinking encourages an appreciation of the complexity of the world. The complexity encourages us to maintain several possibilities at once. In a single lifetime, we may have no way to remove the ambiguities from these possibilities.

A scientist may tend to favour one story over the others, but will always be careful to concede uncertainty and maintain a willingness to change the balance with new, incoming information. As an example, there are two very different interpretations about the reality underlying quantum physics. It is possible that there will be no way to ever know which is correct, or if instead some entirely new theory is correct. And that ambiguity is accepted as part of the enormity of the mysteries we face, and the terms of the agreement we have with nature.

So while there are plenty of good books by scientist-atheists, they sometimes under-emphasise the main lesson from science: that our knowledge is vastly outstripped by our ignorance. For me, a life in science prompts awe and exploration over dogmatism.

A life in science prompts awe and exploration over dogmatism

Given these considerations, I do not call myself an atheist. I don't feel that I have enough data to firmly rule out other interesting possibilities. On the other hand, I do not subscribe to any religion. Traditional religious stories can be beautiful and often crystallise hard-won wisdom - but it is hardly a challenge to poke holes in them. Religious structures are built by humans and brim with all manner of strange human claims - they often reflect cults of personality, xenophobia or mental illness. The holy books of these religions were written millennia ago by people who never had the opportunity to know about DNA, other galaxies, information theory, electricity, the big bang, the big crunch, or even other cultures, literatures or landscapes.

So it seems we know too little to commit to strict atheism, and too much to commit to any religion. Given this, I am often surprised by the number of people who seem to possess total certainty about their position. I know a lot of atheists who seethe at the idea of religion, and religious followers who seethe at the idea of atheism - but neither group is bothering with more interesting ideas. They make their impassioned arguments as though the God versus no-God dichotomy were enough for a modern discussion.

What if we were planted here by aliens? What if there are civilisations in spatial dimensions seven through nine? What if we are nodes in a vast, cosmic, computational device? Wouldn't that make their debates seem limited, in retrospect? I don't think the important goal should be to fight for a particular story in the absence of strong evidence; it should be to explore and celebrate the vast possibilities.

Consider the enormous "possibility space" of stories that can be dreamed up. Take the entirety of the Judeo-Christian-Islamic tradition as a single point in this possibility space. The eastern religions are another point. Strict atheism is another point. Now think of the immense landscape of the points in between. Many of these points will contain stories that are crazy, silly, or merely wildly improbable. But in the absence of data, they can't be ruled out of that space.

This is why I call myself a "possibilian". Possibilianism emphasises the active exploration of new, unconsidered notions. A possibilian is comfortable holding multiple ideas in mind and is not driven by the idea of fighting for a single, particular story. The key emphasis of possibilianism is to shine a flashlight around the possibility space. It is a plea not simply for open-mindedness, but for an active exploration of new ideas.

Is possibilianism compatible with a scientific career? Indeed, it represents the heart of science. Real science operates by holding limitless possibilities in mind and working to see which one is most supported by the data. Sometimes it is difficult or impossible to gather data that weighs in - and in those cases we simply retain the possibilities. We don't commit to a particular version of the story when there is no reason to.

Possibilianism does not suggest free rein to believe whatever strikes one's fancy. It is not tantamount to "anything goes". We know a great deal, not only about the cosmos and molecules, but also about human yearning, fallibilities, poor memories and our extraordinary ability to fabricate any variety of fantastic but utterly untrue stories. Within the realm of what is addressable, we profitably apply logic to further knowledge. Possibilianism is "anything goes at first" - but we then use science to rule out parts of the possibility space, and often to rule in new parts.

In every generation, people are seduced by the idea that they possess all the tools they need to explain the universe. They have always been wrong. From consciousness to dark energy, we know that we are missing an unknowable number of pieces of the puzzle. This is why in the debates between the strict atheists and the fundamentally religious, I choose a third side. A little less pretence of certainty and a little more exploration of the possibility space.

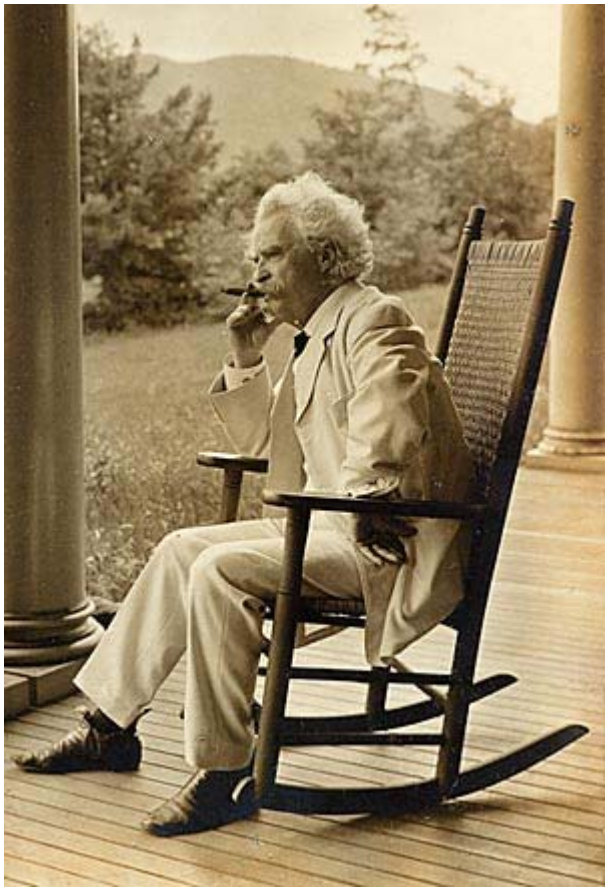
As Voltaire put it, "Doubt is not a pleasant condition, but certainty is absurd."

Profile

David Eagleman is a neuroscientist at Baylor College of Medicine in Houston, Texas. He directs both the Laboratory for Perception and Action and the Initiative on Neuroscience and Law. His book of "possibilian" tales, *Sum*, became an international best-seller and is published in 22 languages

http://www.newscientist.com/article/mg20727795.300-beyond-god-and-atheism-why-i-am-a-possibilian.html

Mark Twain: A Skeptic's Progress
September 17, 2010, through January 2, 2011



The Morgan Library & Museum and The New York Public Library—which hold two of the world's great collections of manuscripts, rare books, letters, and other items related to the life of Mark Twain (1835–1910)—present a major exhibition at the Morgan exploring a central, recurring theme throughout the iconic author's body of work: his uneasy, often critical, attitude towards a rapidly modernizing America. The exhibition coincides with the 175th anniversary of Twain's birth in 1835 and includes more than 120 manuscripts and rare books, including original manuscript pages from *Adventures of Huckleberry Finn* (1885) and *Life on the Mississippi* (1883), as well as letters, notebooks, diaries, photographs, and drawings associated with the author's life and work.

Mark Twain's life spanned an era that saw much of the world—America in particular— embrace the Industrial Revolution. With the expansion of transportation and communications technology, there was a cultural shift from small-town rural concerns to a large-scale national agenda centered on great cities. As a young man, Twain had traveled by foot, horse, and riverboat. As a mature man, and one of the most widely traveled Americans, he journeyed by international steamship and railroad, and even saw the advent of the automobile.

For Twain, such technological, industrial, and urban developments were the means by which America might become a more prosperous and just society and also realize the nineteenth-century dream of universal progress. While he saw this achievement embodied by the concentration of educational and cultural institutions in Northern cities and towns, his conflicted love affair with his native South and its traditions, his close observation of the natural world, and his skepticism about the possibility of changing human nature made him doubtful about the effectiveness of these means or even the possibility of human progress. In his final two decades, the skeptic saw his worst fears justified by the advance of European imperialism and its attendant atrocities in Africa and Asia, as well as by America's own expansionist ambitions. Throughout his life's journey, only his faith in the clarity and cleansing possibilities of the written word remained constant. *Mark Twain: A Skeptic's Progress* captures the essence of the author's wit, humor, and philosophy towards his era's great changes in all their guises, with examples of his work as a novelist, short-story writer, fabulist, critic, lecturer, and travel writer.

THE EXHIBITION
Samuel Langhorne Clemens—better known by his pen name, Mark Twain—was the quintessential American

author, humorist, lecturer, essayist, and master of satire. Twain enjoyed immense public popularity during his lifetime and became a friend to presidents, artists, industrialists, and royalty.

The exhibition features extensive portions of autograph manuscripts of two key non-fiction works. In *Life on the Mississippi* (1883), Twain examines the history of the river and the impact of technological progress and urban development on river life and paints sharply contrasting portraits of urban life in the North and South. Twain casts his critical attention more widely in the extensive account of his world travels published in *Following the Equator* (1897), employing savage sarcasm to express his outrage at the crimes that the Western colonial powers perpetrated on the native populations of Africa, Asia, and Australasia.

Life on the Mississippi is Twain's memoir of his youthful years as a cub pilot on a steamboat paddling up and down the Mississippi River. The author used his childhood experiences growing up along the Mississippi in a number of works, but nowhere is the great river and the pilot's life more thoroughly described than in this account. Told with insight, humor, and candor, *Life on the Mississippi* is an American classic. Twain's deep nostalgia for the world of his youth gives special acuity to his observations on advances in technology, urban development, agriculture, manufacturing, transportation, and social justice, which changed the traditional culture of the South while bringing benefits to many.
An inveterate traveler, Twain crisscrossed the Atlantic more than a dozen times and also visited Turkey, Palestine, Hawaii, Australia, India, and South Africa. Wherever he went, he always absorbed the scenery and in his mind played the part of the American Vandal, the rube traveler who pretends to understand things he doesn't. The exhibition includes autograph manuscripts and an extensive display of illustration mock-ups, comprising numerous photographs and drawings for *Following the Equator* (1897), Twain's final work of travel literature, which began with the wildly successful *The Innocents Abroad* (1869).
Also on view are four pages of Twain's greatest work, *Adventures of Huckleberry Finn,* called by Ernest Hemingway the source of all modern American literature and numerous leaves of the autograph manuscript of *A Connecticut Yankee in King Arthur's Court* (1889), a fable that grows increasingly grim as Twain shows how the well-intentioned use of technology leads to self-destruction because of humanity's incorrigible selfishness and need to worship authority. The pages from *Huckleberry Finn* are from the first half of the book, which was thought lost and only found in 1990, and depict Huck and Jim on their raft in the Mississippi as well as a ribald song sung by a boatman, and which Twain is believed to have sung at his own wedding.

Twain's numerous attempts to participate in and capitalize on the entrepreneurial spirit of the times were predominantly failures. The exhibition introduces his experiments and includes an example of a memory game for acquiring and retaining all sorts of facts and dates. The original three-piece game was conceived and designed by Twain and produced by Charles L. Webster & Co. in 1891. The game includes a boxlike board with the game printed on one side and rules on the other, as well as a small pamphlet of facts, along with a box containing the playing pins.
The exhibition is supplemented with handwritten manuscripts and typescripts of other works by Twain, his letters and correspondence, drawings and illustration mock-ups for printed editions, photographs, and several three-dimensional artifacts.

Mark Twain: A Skeptic's Progress is co-curated by Isaac Gewirtz, Curator of the Henry W. and Albert A. Berg Collection of English and American Literature at The New York Public Library and Declan Kiely, Robert H. Taylor Curator of Literary and Historical Manuscripts at the Morgan.

This exhibition is generously supported by the Margaret T. Morris Fund for Americana and Mr. and Mrs. Jeffrey C. Walker, with additional assistance from the Gladys Krieble Delmas Foundation, The Carl and Lily Pforzheimer Foundation, and the F. M. Kirby Foundation.

http://www.themorgan.org/exhibitions/exhibition.asp?id=33

Roy Lichtenstein: The Black-and-White Drawings, 1961–1968
September 24, 2010, through January 2, 2011

Roy Lichtenstein (1923–1997) has long been considered one of the key figures in the development of Pop Art. His signature brightly colored paintings are cornerstones of museum collections the world over. His subject matter drawn from visual fragments of popular culture is emblematic of an entire movement.

Roy Lichtenstein, *I Know How You Must Feel, Brad!,* 1963, graphite pencil, pochoir, and lithographic rubbing crayon. Private Collection. © Estate of Roy Lichtenstein. Photography: Schecter Lee, 2009.

An extraordinary new exhibition organized by The Morgan Library & Museum, opening September 24, presents an important series of large-scale, black-and-white works as a group for the first time and examines Lichtenstein's less known exploration of the medium of drawing. Created during the early and mid-1960s, the fifty-five drawings on view offer a revealing window into the development of Lichtenstein's art, as he began for the first time to appropriate commercial illustrations and comic strips as subject matter and experimented stylistically with simulating commercial techniques of reproduction—the famous Benday dots. The work represents an essential and original contribution to Pop Art as well as to the history of drawing.

ROY LICHTENSTEIN IN THE EARLY 1960S

The year 1961 was a momentous period of transformation for Roy Lichtenstein. Thirty-eight years old and regularly exhibiting in New York since 1951, he was by many measures already a midcareer artist, working primarily in painting in Cubist and Abstract Expressionist styles. But in 1961 his art made a radical departure from these precedents. Influenced by the happenings staged by Allan Kaprow, George Segal, Claes Oldenburg, and others, which incorporated everyday objects and popular culture, Lichtenstein turned to an entirely new imagery culled from the contemporary world of advertisements and comic books and adopted the graphic techniques of commercial illustration. The exhibition demonstrates how the act of drawing took on a central role in his practice at this stage, both as a favored medium in its own right, as well as a powerful means of translating and transforming his sources of pop iconography.

THE EXHIBITION

The exhibition provides a rare opportunity to study Lichtenstein's black-and-white drawings as a group, to explore their technique and subject matter, to draw attention to Lichtenstein's revolutionizing contribution to

the history of drawing, and to bring to light the critical insights these drawings offer into the artist's larger body of work.

The drawings constitute an original body of work independent from Lichtenstein's paintings. Although he produced many black-and-white paintings during the 1960s, the drawings were in fact conceived independently and cannot be interpreted as studies for the works on canvas. Lichtenstein's motivations in creating these works—which did not have the commercial value of paintings—remain enigmatic, though the exhibition provides some background. Moreover, these drawings differ significantly from Lichtenstein's main body of works on paper. They do not belong to the category of preparatory studies and also stand apart from the drawings of other major pop artists, notably Claes Oldenburg, Andy Warhol, and Jim Dine, whose treatment of pop subjects cultivated an old-master look that is absent from Lichtenstein's black-and-white drawings.

The exhibition traces the development of Lichtenstein's drawing style in the 1960s, notably his technique of simulating the Benday dot printing process—a characteristic feature of his style. The viewer can follow the development of the black-and-white drawings through the rendering of these dot patterns. Lichtenstein never drew them freehand but experimented with a variety of approaches, which he perfected over the years to mimic the effect of mechanical printing.

This technique became inseparable from the meaning of the finished work, producing, in the words of critic Lawrence Alloway, "an original artwork pretending to be a copy." By imitating mechanical modes of reproduction, Lichtenstein presented a critical challenge to prevailing notions of artistic originality and authorship, paradoxically achieving an unmistakable hallmark of style in the process.

The exhibition also explores the sources—comic strips, advertisements, magazines, and mail-order catalogues—of Lichtenstein's subjects. In addition to the drawings themselves, related sketches are on display as well as clippings from newspapers, magazines, telephone books, and other sources from which Lichtenstein drew inspiration for the works in the exhibition. The show underscores the two themes that came to dominate the drawings—household objects and comic-book scenes of war and romance—and illustrates how Lichtenstein endowed them with a heightened psychological resonance and formal intensity, raising them to the level of high art.

EXHIBITION HIGHLIGHTS

The earliest drawings are also the most basic. A centrally placed, single object often stands against a blank background: an airplane, a couch, a cup of coffee. Others are based on diagrams demonstrating how to use a product by depicting a hand or foot interacting with an object, such as *Hand Loading Gun* and *Foot Medication*. When figures are included, as in *Man with Coat* and *Girl with Accordion*, they have plain, ordinary features, as oppose to the conventional beauty of male and female figures that would soon appear in his comic-inspired works.

By 1962, the drawings began to incorporate more elaborate source images, which introduced more complex compositions. *Keds*, for instance, was inspired by an advertisement for Sears, Roebuck & Company. In a sly reference to contemporary abstract art, Lichtenstein significantly reworked the composition to give greater emphasis to the geometric pattern of the sole. *Bratatat* and *Jet Pilot* are two drawings inspired by war comics. Both are close-up views of a pilot in his cockpit, with much attention lavished on the details of his accoutrements.

The exhibition also includes a piece from a little-known installation done by Lichtenstein in 1967 that represents an extension into three dimensions of his black-and-white drawings on paper. As part of the Aspen Festival of Contemporary Art, Lichtenstein drew with black tape on the wall of a white room, outlining its architectural elements. The only extant part of this project, a door with the words *Nok!! Nok!!* is featured,

together with unpublished photographs of the whole room.

Roy Lichtenstein: The Black-and-White Drawings, 1961–1968 introduces an entirely new dimension of the artist's work to audiences more accustomed to seeing his brightly colored paintings. Although Pop art in general has been the subject of a number of shows, they have featured few drawings and rarely addressed the practice of drawing by Pop artists.

The exhibition is organized by Isabelle Dervaux, curator of Modern and Contemporary Drawings at the Morgan. After it closes in New York, it will travel to The Albertina in Vienna, Austria (January 27 through May 15, 2011).

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http://www.themorgan.org/exhibitions/exhibition.asp?id=34

Is Michelle Rhee's Revolution Over?

By JUDITH WARNER

Around the country, supporters of education reform — or at least of the test-scores-driven, tenure-busting, results-rewarding sort of reform epitomized by organizations like Teach for America and championed by Education Secretary Arne Duncan — gave a collective gasp of dismay last month when voters in a number of districts handed primary defeats to candidates closely associated with just this type of reform. In New York, three state-senate candidates who ran on pro-charter-school platforms each failed to garner more than 30 percent of the vote. In Washington, voters overwhelmingly rejected Mayor Adrian Fenty in favor of the City Council chairman, Vincent Gray, as the Democratic candidate in this year's mayoral election. The Fenty defeat worried many people particularly because he was inextricably linked with his crusading, nationally celebrated schools chancellor, Michelle Rhee.

Rhee, who was appointed by Fenty in 2007 and given unprecedented power to shake up the ailing school system, fired hundreds of teachers and dozens of bureaucrats and principals, even removing the popular head of her daughters' elementary school in the northwest part of the district. She demanded that the city's tenure system be replaced with one that would reward teachers for producing measurable performance gains in their students. For her efforts, she became a heroine to some — gracing the cover of Time magazine, earning the praise of the Obama administration and an invitation to appear on "Oprah" — but she also received enormous enmity from teachers, their unions and, surprisingly enough to outside observers, many public-school parents, not a few of whom were profoundly offended when, the night after the mayoral primary, Rhee appeared at the Washington premiere of Davis Guggenheim's much-talked-about education documentary, "Waiting for Superman," and told an assemblage of prominent Washingtonians that the election results "were devastating, devastating. Not for me, I'll be fine . . . but devastating for the school children of Washington, D.C."

In the local blogs that buzzed with outrage after Rhee's comment, a theme became clear: people — even people who seemed destined to most benefit from the work of a committed reformer like Rhee — don't like to get the message that their communities are on the wrong track. That their schools are no good, the teachers in them subpar; that their decision to back a politician who doesn't share the reformer's particular style of quasi-missionary zeal would consign their kids to disaster.

It became clear that people don't much like stern-faced do-gooders telling them how to think and what to do; that they prefer "a reform agenda that's being done *with* people, not *to* people," as Randi Weingarten, the president of the American Federation of Teachers, recently put it. They don't like collective slap-downs — like the one Rhee managed when she referred to the hundreds of fired teachers indiscriminately in an interview with a business magazine as people who "had hit children, who had had sex with children." They don't like to see respected members of their community seemingly compared to dirt, as Rhee unthinkingly did by agreeing to pose on the cover of Time wielding a big broom. They like policy makers who at least appear to be taking their concerns to heart, as Rhee pointedly did not, bluntly telling the magazine: "I'm not going to pretend to solicit your advice so you'll feel involved, because that's just fake."

Washington residents, the majority of them African-American, many of them poor, all possessed, to varying degrees, of a sense of disenfranchisement — the city, after all, did not have the power to elect its own government until 1974 and must still submit its budget and laws for approval to Congress, where it lacks voting rights — take particularly poorly to these sorts of put-downs, says Michael Fauntroy, an associate professor of public policy at George Mason University. In fact, the black, often struggling residents of Washington — the vast majority of parents in the public-school system — have a hair-trigger intolerance for anything that smacks of paternalism or disdain by policy makers, particularly when they appear to be telling people how to run their lives and, most potentially offensive of all, how to educate their children. Fenty and Rhee, Fauntroy said, were perceived to have "an elite view of public policy: we know what's better for your kids than you do, and because our ideas are better, yours are to be ignored, and ours are to be implemented." That sentiment is not unique to African-American residents of Washington who voted for Gray. It runs through much of the chorus of opposition to President Obama and his reformist policies — health reform in particular — and it's easily tapped into by candidates who position themselves as plain-talking "real people," alternatives to the powers that be. Which explains, perhaps, why so many primary elections this year left some outside observers reeling, as was the conservative Washington Post columnist Charles Krauthammer, at the "reckless and irresponsible" decision of key Republicans to endorse Christine O'Donnell, who was backed by Tea Party members, as the Republican Senate candidate in Delaware. Krauthammer viewed this as a self-defeating choice that would condemn Republicans to failure in the general election. Many Washington residents who favored Fenty — including those in the white, largely upper-middle-class homes of Ward 3 (which voted 80 percent for Fenty) — expressed similar concerns in criticizing their neighbors' selection of Gray for mayor, given the great improvements in city services and education that they had seen under Fenty.

The Tea Party candidates who surprised national observers and the Republican establishment by winning this month couldn't be more different than the thoughtful, mild-mannered Gray, his liberal sympathies as deep as his Washington roots. The voters who elected him, it is fair to say, have nothing politically in common with those who brought O'Donnell her upset victory. But it may well be that the sort of rage that fuels the mostly white, middle-class, conservative Tea Party movement has, at least in part, a similar root: a rejection of whip-smart policy makers who believe they know best and who — it seems to those who feel slighted by them — lack the common decency to try not to show it.

Judith Warner is the author, most recently, of "We've Got Issues: Children and Parents in the Age of Medication."

http://www.nytimes.com/2010/10/03/magazine/03fob-wwln-t.html?ref=magazine

Are Bad Knees in Our Genes?

By GRETCHEN REYNOLDS

Lewis Mulatero/Getty Images

Are fragile knees inherited? That intriguing question motivated a new study published earlier this month in The British Journal of Sports Medicine, during which researchers looked at one family's propensity for shredding anterior cruciate ligaments during sports. The report was part of a much larger, ongoing study of risk factors for A.C.L. injury, led by researchers affiliated with the Cincinnati Children's Hospital and Ohio State University, which involves thousands of young athletes. For this pocket version of the larger experiment, the scientists singled out a set of fraternal twin girls who already had been videotaped in the laboratory while wearing reflective markers. The angles of their knees during landing and cutting maneuvers had been analyzed, and the knees themselves measured. At the time of the taping, both girls' knees were healthy. But within a year, each had suffered a catastrophic A.C.L. tear during separate volleyball and basketball games, as had an older sister, who wasn't part of the original study.

"We thought this repeated incidence of A.C.L. tears within one family was important to look at," said Timothy Hewett, the director of sports-medicine research for Ohio State University and Cincinnati Children's Hospital and lead author of the new study. "In my lab, we have another set of twins, identical young women, who are post-docs. They both had torn their A.C.L.'s" as high school athletes. "Their father, who is one of a set of triplets, also had torn his A.C.L.," as had his two triplet brothers, Dr. Hewett said. "Those incidences," together with the injuries to the fraternal twins, "made us wonder, How much does familial predisposition influence your risk for an A.C.L. tear?"

The answer may be quite a bit. What Dr. Hewett and his colleagues found when they parsed the data about the fraternal twin girls' knees was that each had unusually loose, flexible knee joints, or "Gumby knees," as Dr. Hewett called them. Each also angled at least one knee outward during landings and had narrower-than-average notches in the knee bone, where the A.C.L. attaches to the bone. Each of these conditions previously had been identified as a risk factor for an A.C.L. tear, but they hadn't been shown to cluster within a family. "It appears that the propensity to be at high risk for an A.C.L. tear is definitely heritable," Dr. Hewett said.

Anyone who has an active daughter or who follows the sports pages knows that the incidence of non-contact-related A.C.L. tears among young female athletes is high and increasing. Many strength- and balance-training programs have been developed to try to reduce the number of these A.C.L. injuries. But part of the problem with the
training programs, Dr. Hewett said, "is that they'll only work if they reach the girls who actually are at risk," because of how their knees are built. "Otherwise it's like giving antibiotics to someone who doesn't have an infection. It won't work."

As a result, some of the most engrossing recent A.C.L. injury research has been aimed at finding at-risk knees, in part by probing the genetics of weak A.C.L.'s. In the past year, a flurry of new studies have identified several genes that seem to be closely associated with A.C.L. tears. One representative experiment, produced by scientists at the University of Cape Town in South Africa and published in June, sequenced gene segments from 129 volunteers who had torn an A.C.L., 38 of them women, and compared them with the same gene sequences in 216 active but uninjured people (a third of them were women too). They found that the women who had torn their A.C.L.'s were significantly more likely to share a specific variation in one of their genes. The gene is known to affect the suppleness of collagen or connective tissue in tendons and ligaments like the A.C.L. Most of the men in both groups and the uninjured women didn't have that genetic variant. Similarly, in another experiment by the same group of scientists, published in November, a separate gene variant was found to be more common in women who had ruptured their A.C.L.'s. That gene variant also affects the makeup of the collagen in tendons. No one knows yet whether women who carry both variants of the genes might be at especially high risk of an A.C.L. rupture.

But the emerging genetics of A.C.L. injury do raise the possibility that "in the not-so-distant future we might be able to screen" the DNA of young athletes and find those at highest injury risk, Dr. Hewett said. Obviously, he added, much work remains to be done in the field. The genetic variants so far associated with A.C.L. injury risk have been found primarily in injured women. But men injure their A.C.L.'s, in higher raw numbers than women, since so many more men participate in sports that threaten knees (soccer, basketball and skiing, for instance). Are there genetic risk factors for men? Should all young athletes be screened, if and when a viable screening test becomes available? And given that no A.C.L. injury prevention program has yet proved wholly successful, what advice do you give a young woman athlete whose genetic test shows that her knee is extremely vulnerable?

"There's so much we still have to learn and think about," Dr. Hewett said.

For now, the takeaway from the current research is simple. Look to your family. "If you have a first-generation relative, a sibling or parent, who has torn an A.C.L., you are likely to be at above-average risk," Dr. Hewett said, and might want to investigate the availability of A.C.L. injury prevention programs in your area. You also can find self-guided programs online at a number of Web sites and on YouTube. Genetics will, of course, never provide "all of the answers to the question of why" some people tear an A.C.L. and others in the same situation do not, Dr. Hewett said. "But this field does give us another piece of the puzzle."

http://well.blogs.nytimes.com/2010/09/29/phys-ed-are-bad-knees-in-our-genes/?ref=magazine

The BP-Spill Baby-Turtle Brigade

By JON MOOALLEM

Loggerhead nesting season started this year, as usual, in May. Across the northeastern coast of the Gulf of Mexico, female sea turtles began plodding out of the water and up the beach, each burying a clutch of a hundred or more leathery eggs beneath the sand. The eggs incubate for about 60 days. Then a throng of tiny black loggerhead hatchlings, each only about two inches long, frantically boils out of the ground, all paddling clumsily with their outsize, winglike flippers. They scuttle down the beach en masse, capitalizing on a one-time frenzy of energy to rush into the water and push past the breakers into offshore currents. Once they make it there — if they make it there — they typically find their way onto mats of seaweed called sargassum. The hatchlings will drift passively around the ocean on this sargassum for the first several years of their lives, like children inner-tubing in a swimming pool. It's a life raft from which, conveniently, they can also pluck snacks. Many turtles wind up gliding around the Florida peninsula and floating as far out as the Azores during a developmental stage biologists call "the lost years."

The hatchlings from this season's first nests, however, were on schedule to scramble into the Gulf of Mexico only a few months after the explosion of the Deepwater Horizon rig, at what looked to be the height of one of the worst man-made environmental disasters in history. By June, the sargassum in that part of the gulf was heavily oiled. Soon, it appeared to be largely gone: incinerated in controlled burns, maybe, or hauled up by skimmer boats. And so state and federal wildlife agencies came up with a radical plan. Sea-turtle eggs laid on beaches in Alabama and the Florida Panhandle would be dug up during their very last days of incubation, packed into Styrofoam coolers and shipped to a climate-controlled warehouse at the Kennedy Space Center on the opposite coast of Florida. There, after hatching, the baby turtles would be released into the oil-free Atlantic. When I arrived in Alabama in late July, tens of thousands of turtle eggs, from hundreds of nests, were already in the process of being relocated — all during a point in their development when even a slight jolt to the egg could be lethal. In short, America was orchestrating the migration of an entire generation of sea turtles, slow and steady, overland, in a specially outfitted FedEx truck.

The government called this effort a set of "extraordinary measures being taken in direct response to an unprecedented human-caused disaster." And as one U.S. Fish and Wildlife Service biologist told me, "We immediately knew it was more work than we could do on our own." Fortunately, a vast and well-organized infrastructure of volunteers was already in place: people who, for years, happened to have been honing some of the very skills that the survival of these imperiled animals suddenly hinged on — not because they saw such a crisis coming, but basically because they *really* loved turtles.

What I found in Alabama was a classic story of ordinary people called to do extraordinary things. But the extraordinary things were so eccentric, and the ordinary people were so unassuming, that it took me a while to realize that. In the middle of an environmental emergency that seemed to demand dispassionate and scientific decision making, it was an emotional connection to turtles — and, in some cases, a slightly *over*emotional one — that wound up making certain people indispensable.

Two of these people — a retired man and his mostly retired wife — stood on a beach in Gulf Shores, Ala., at dawn one morning in late July, guarding a set of loggerhead tracks in the sand. The man stood with his hands on his hips. The woman ambled near the water, with a white sun visor on and a Royal Caribbean fanny pack slung over one shoulder. These were the Gormleys: Dan and Jan.

The five species of sea turtle that nest on American beaches, including the loggerhead, are listed as either "threatened" or "endangered" under the Endangered Species Act. And so, all summer, wherever the turtles come ashore — along the Gulf Coast, around Florida and up through the Carolinas — volunteers like the Gormleys help wildlife agencies patrol the beaches, looking to cordon off and protect any new nests. Finding the nests isn't easy. After laying the eggs in a hole in the sand in the middle of the night, the female loggerhead fills it and sloshes around to camouflage it. The tracks a female leaves, as it goes back and forth from the water, are called a turtle crawl, and the crawl is usually the only conspicuous evidence that a creature weighing several hundred pounds has even been there. Volunteers have to get on the beach first thing every morning before any new crawls are obscured by tourists' footprints, or beach chairs or college students dragging coolers of Budweiser up and down the sand (which, maddeningly, leave trails that look a lot like loggerhead crawls). This summer, on the Gulf Coast, the volunteers were also having to contend with the obliterating tracks of BP's cleanup crews: the brigades of ATVs and tractors, which liked to get an early start.

The volunteer effort in every coastal community has its own name — Panama City Beach Turtle Watch, the Brevard County Sea Turtle Preservation Society, Sea Turtle Oversight Protection of Broward County. But the volunteers are known universally as turtle people. For some, being a turtle person is a colorful seasonal interest — an excuse to wake up early and take a stroll on the beach; for others, it's an identity. Ask the head turtle person in Walton County, Fla., to pick you up at your hotel one morning, and a 68-year-old woman with three turtle tattoos on her legs will arrive in a truck with turtle-printed seat covers, plush-toy turtles on the dash and a turtle decal on each door. You'll know it's her because the license plate says TURTLE.

In Alabama, since 2001, an all-volunteer nonprofit group called Share the Beach has deployed turtle people to walk all 47 miles of white sandy beaches in the state every morning during nesting season — about 35 turtle people a day, from a standing army of 300 volunteers, all on the lookout for nests laid the night before. Aunts and nieces walk together; solitary old men; chattering foursomes of ladies who appreciate the exercise. Share the Beach divides the coast into eight sections, each covered by a different team. (One team jointly patrols a stretch of federally protected coastline with Fish and Wildlife employees.) Each team's leader reports to the group's director, an Alabaman real estate agent named Mike Reynolds, who told me he modeled this structure on the Incident Command System for humanitarian disaster response. (Reynolds flies in the Civil Air Patrol on weekends.) "Mike's got an awesome organization — they're an *awesome* group," a Fish and Wildlife spokeswoman, Denise Rowell, told me. When the spill started, Rowell's office asked Share the Beach to photograph the entire coastline of Alabama, as baseline documentation for any litigation or recovery efforts. Reynolds delivered thousands of photographs, taken every 500 feet, in 48 hours.

Not long after I found the Gormleys and their turtle crawl, their team leader, a softspoken woman in her mid-50s named Sherry Sander Parks, arrived on the scene with a box of supplies and a band of reinforcements. Among them was an upbeat older lady named Nan Duncan, new to Share the Beach. “I went out last year with the Debbies and got the fever,” Duncan told me. There are at least seven Debbies in the organization. One of them, Debra Kline, was standing behind me, filling out paperwork to document the crawl. Kline’s husband, Denny — who, before they retired to Gulf Shores, was a top forensic bomb expert in the F.B.I. — hung back with the other husbands, enjoying an unlit cigar.

Half of all loggerhead crawls are “false crawls”: the turtle turns around and leaves without laying eggs. So the first step for the volunteers was to dig gingerly into the sand with their fingertips and see what, if anything, was buried at the end of the tracks. Parks distributed blue gloves. Duncan dropped to her knees and cracked right in. Jan Gormley balked, and Debra Kline shrugged in her direction to explain: “Knee replacement,” she said. Parks, meanwhile, was trying to get the word out to the rest of her team. “Debbie,” she said, “will you call Debbie?”

Two frustrating hours later, they’d dug a pit six or seven feet wide and 18 inches deep. They were standing in it, like giant children burrowing to China. Suddenly, Parks felt something. Then she screamed: “We’ve got eggs!” They surrounded the nest with wooden stakes and brightly colored tape.

Most turtle-watch groups stop there. But because Alabama gets relatively few nests — only about 80 per year — Share the Beach can offer its loggerheads several further levels of protection. In a normal year, 55 days after each nest is laid, volunteers would stay up beside the nest all night, for several nights, listening with a stethoscope for the first rustling of hatchlings underground. Then they’d string up a tarp, shielding the nest on three sides from the artificial light of beachfront development and roads. (Bright lights disorient hatchlings, luring them in the exact opposite direction — away from the water — from the one they need to be going in.) Volunteers would then dig a flat-bottomed trench in the sand, from the nest all the way to the water, to keep the hatchlings on course. Then they’d take shifts waiting. “It’s just us, kind of like a family group waiting for someone to have a baby,” one of the Debbies told me. They call it “nest-sitting.”

Watch a nest erupt and the hatchlings sprint for the water just once and you’re hooked, the turtle people all told me. “You’re just wondering how God put all this together,” one man said. And since 2001, Alabama’s turtle people have helped about 80,000 loggerhead babies make it into the Gulf; before Share the Beach started, Fish and Wildlife estimates, very few hatchlings were surviving. (The organization formed when neighbors found an entire nest’s worth of hatchlings squashed or flailing in an illuminated parking lot one morning and decided they had seen enough.) But this year there would be no nest-sitting, no tarp and no trench, and no mobs of turtle people and tourists watching as the hatchlings raced to the water. The turtle people’s entire turtle protocol was being upended and pre-empted. Instead, Parks’s team was supposed to dig up the eggs from this new nest in 50 days and pack them onto a truck for Florida. Maybe, Parks said, they should all stay up on the beach one night anyway, just telling stories.

The first turtle people were just people, improvising ways to help the sea turtles around them. In the 1980s, as hurricanes approached, some residents fortified the nests in front of their houses with sandbags. (Nests can withstand some water inundation, but eventually the embryos asphyxiate.) Or else people dug up eggs in the middle of hurricanes, in the dark, plunging their arms into the sand as each wave broke behind them, to anchor themselves and not lose track of the nest. Then they’d stash the eggs in buckets in their kitchens or trucks and rebury them when the storm passed. A woman in eastern Florida, I was told, liked to dress the hatchlings up in tiny clothes before they marched down the beach.

In the late ’80s, Florida began standardizing these peoples’ activities, training them and issuing them the permits necessary to work with endangered species. Their early morning patrols have now become one of the key generators of scientific data for loggerheads. The picture that has emerged is of a species in steep decline.

On the Atlantic coast of Florida, for example, one of two big hot spots for loggerheads in the world, the number of nests discovered has dropped by more than 40 percent in the last decade. Still, it's unclear how precisely that reduction of nests correlates to a decline of actual turtles in the ocean. The data also don't give conservationists any sense of how many loggerheads there *should be* — what their natural population levels were before they were diminished by artificial light, commercial long-line fishing and other man-made threats. The loggerhead is a 70-million-year-old species, a lumbering holdover from the age of dinosaurs. But it's difficult to gauge how many turtles there were before there were turtle people there to count them.

"Conservation has to depend more and more on volunteers, including retired people and students," Alan Bolten, a sea-turtle biologist at the University of Florida, told me. "Because, one, we can't afford to pay all these people to do this work, and two, who has the time to be on the beach every morning, doing the count?" For decades, other volunteers have been providing similarly valuable long-term population data through annual surveys of birds, frogs and butterflies. The Princeton ecologist David Wilcove compares this wave of citizen-scientists to volunteer firefighters: they fill a crucial niche, as the U.S. Fish and Wildlife Service's budget for conservation has essentially stagnated and its workload has spiked.

The turtle-egg evacuation was devised jointly by Fish and Wildlife, the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration and the Florida Fish and Wildlife Conservation Commission (F.W.C.). These agencies immediately understood that their plan depended on the presence and participation of turtle people. "I don't see how we could have done it without them," says Robbin Trindell, a top sea-turtle biologist with the F.W.C. For one thing, they couldn't have moved any nests if turtle people hadn't already been out there on the beach locating and marking them. Fish and Wildlife's national sea-turtle coordinator, Sandy MacPherson, told me: "We totally rely on those groups every year. This year, we are asking them to go above and beyond what they normally do, which is already above and beyond."

How pressing an ecological matter is the egg relocation? The northeast Gulf Coast gets only about 700 loggerhead nests a year; the east coast of Florida, where they're being transplanted, gets upward of 60,000. Thus the motivation for the entire enterprise sits in a kind of gray area between scientific conservation and simple compassion. Trucking those nests to Florida may arguably be less a crucial intervention to sustain the overall health of the species than a straight-up rescue mission to keep those individual little Gulf Coast hatchlings from, as one person involved in the planning put it to me, "swimming to their deaths."

The architects of the plan felt that moving the nests was justified in either case. Several people involved in the earliest discussions described the decision to me as "a no-brainer." (BP is paying most of the costs, with FedEx donating the transportation.) "It's the right thing to do, it's feasible and it feels good to do it," says David Godfrey, director of the Sea Turtle Conservancy, who worked with the government on the plan. Moreover, it's tough to predict the ultimate importance of these Gulf Coast refugees to the overall loggerhead population without knowing the long-term damage the spill and the application of so much dispersant might do to the species and its food chain from here on out. "We just don't know what's going to happen," Godfrey says. "It won't be good. It can't be good. It will only be bad."

The evacuation plan was announced in late June. A few days later, with the relocation of Alabama's first nest imminent, Share the Beach's eight team leaders were called by federal authorities to a briefing at a wildlife refuge near the city of Gulf Shores. A protocol had been issued, detailing exactly how the eggs should be handled and packed into specially constructed, sterilized coolers. Dianne Ingram, a Fish and Wildlife biologist, buried some Ping-Pong balls and golf balls in the sand behind the refuge office. Then she asked a team leader, Sherry Sander Parks, to excavate them. They were going to practice.

Ingram told me that among the team leaders, there's a feeling of ownership, or at least devout responsibility for the nests — a commitment to safeguarding the eggs while they incubate, then helping the hatchlings into the water. Fish and Wildlife wanted to honor that connection by entrusting the team leaders with actually

handling the eggs. More to the point, the agency didn't have enough manpower to move all the nests by itself. And even more fundamentally, there was an issue of expertise. "Sherry has handled many more eggs than I have," Ingram said.

Standard operating procedure for Share the Beach is to immediately move any nest laid below, or even close to, the high-tide line. This minimizes the risk of flooding. Lots of measurements are taken; a new nest is dug farther from the shore, by hand, to the precise dimensions of the original one, and the eggs are reinstalled in the same arrangement. "We make it just like mama turtle did," one team leader explained. This year, about half the nests in Alabama were moved; turtle-watch groups in Florida tend to move nests much less liberally and less often. It's partly a function of volume: since Florida gets so many loggerhead nests a year, just locating the new nests that turn up on a given morning can take volunteers or county workers hours. But it also reflects a philosophical difference. Floridian turtle people are issued their permits by a state wildlife agency, as opposed to by U.S. Fish and Wildlife, and their supervising biologists endorse a far more hands-off approach. "Florida is diametrically opposed to what I do," Reynolds, the Share the Beach director, told me. But he argues that, with Alabama's population so depleted, "we can't afford mama turtle making a mistake and laying too close to the water. We've got to go in and manually correct that mistake."

This is to say that veterans of Share the Beach went into the BP crisis having personally relocated dozens, if not a hundred or more, nests. And yet the same depth of experience that made the Gulf Coast turtle people among the most qualified to execute the egg relocation plan also left many feeling conflicted about it. "It's kind of like it's our turtles," a Share the Beach team leader named Bill Hanks told me. "You get attached to them, almost like a mama-daddy thing." The idea of sending them away stung. And the central question was, will the turtles come back?

Loggerhead females return to nest on roughly the same stretch of beach they themselves hatched on, though no one knows precisely how this internal GPS is programmed. Consequently, relocating the eggs risks inadvertently converting an entire cohort of Alabama turtles into Florida turtles — possibly setting them up to lay their eggs, for the rest of their lives, on the Atlantic coast instead of in Alabama. Moreover, a female loggerhead doesn't start laying eggs until she's about 30 years of age, meaning even the first hatchlings that Share the Beach helped get into the water 10 years ago — the first seeds of the turtle resurgence the group is working for — aren't yet adding to the population. The fear among Alabamans I met was that a year's worth of *their* hard-won turtles would now be folded anonymously into the Floridian masses. "It's something we know we got to do," Hanks said of the plan. Reynolds added: "Their survival is beyond our wants and needs." But even for the most resolute turtle people, there were stages of grief to be worked through.

Parks, for her part, said she had never been convinced that the relocation was truly necessary or worth the risks in the first place. And yet she found herself excavating the first Alabaman turtle eggs to be evacuated on July 12, on a beach not far from her house, ringed by dignitaries and television crews and curious wildlife officials from as far away as Oregon. Reynolds squatted beside her, in his customary Share the Beach green button-down, with his name and title — "Turtle Czar" — embroidered over the pocket. His job was to draw a horizontal line across the top of each egg with a grease pencil before Parks lifted it from the nest; the idea was, she should focus on keeping the line level to avoid inadvertently, and even slightly, swiveling her wrist and killing the hatchling inside. Every so often, as she worked, the cameramen filing up to the nest asked her to pause and hold a particular egg at a more photogenic angle.

Describing the day, a retired postmaster named Debbie Willis, who volunteers on Parks's team, told me: "We just cried. There's nothing else you can do. You just cry. And it's not about us. I feel we've failed all marine life in the gulf. God trusted us with it, and we failed miserably. And we're still failing it." Willis had sent that first shipment of eggs off to the biologists in Florida with a kind of "care package," she said: a few bags of chocolate turtles; a photo book of the crawl and pictures and names of the volunteers who had originally found it; a letter written from the perspective of the hatchlings to their mother ("Well, Mom, the big day is

today. We are being relocated to a place called Florida, Cape Canaveral, or something like that"); and a camera in a self-addressed, stamped envelope, with a request to take lots of pictures.

"I try not to be so anthropomorphic about it; I try not to turn it into a religion," Mike Reynolds told me one afternoon at his condo a few blocks from the beach. "These are not our turtles. We feel like they are. But they're reptiles, you know?"

Reynolds was dealing with a swamp of paperwork at his desk while, across the living room, a Harry Potter movie played with the sound down. The spill had killed Reynolds's real estate business for the summer, but his ever-expanding volunteer turtle duties were swallowing his days up instead. Meanwhile, a BP contractor called P2S, involved in cleaning oil from the beaches in Gulf Shores, had hired him as a staffing agent. Every day, around noon, he'd get an e-mail from P2S asking for a certain number of turtle people to work on the beach that night. They worked 10-hour, overnight shifts, driving little ATVs in tight formation around the high-tech, German-built machines that sifted tar balls out of the sand. The machines had to be deployed at night, when the tar balls cooled and were easier to pick up, and the turtle people's job was to keep a perimeter and make sure this heavy and noisy equipment steered clear of any new, unmarked nests and didn't trample or scare away any turtles coming ashore to nest in the dark. Harassing or harming a loggerhead is a federal offense, punishable by a fine of up to $25,000; destroy a nest of 100 eggs, one law-enforcement agent told me, and the fines "could really stack up." Early on, one cleanup company in the area had a close call, running straight over a nest with a tractor but not damaging any eggs. ("As turtle people, we were appalled," Reynolds told me.) So a P2S subsidiary was now employing dozens of Share the Beach folks every night and paying them $25 an hour for their singular expertise as turtle-crawl spotters. Many were working four or five of these night operations a week — "night ops" as everyone called them — then heading straight to another beach to do their dawn patrols. "I kept calling my people 'Turtle Watchers,' and Incident Command didn't like that," Reynolds told me, meaning BP's central command. "They said, 'Your new name is the "wildlife observer program." ' I said, 'I don't care what the heck you call us.' "

By then, BP's recovery program had institutionalized something that Alabama's turtle people had already started doing on their own initiative. During the first nights of cleanup work, the turtle people simply showed up and started walking along with the sand sifters as volunteers — "just having a ball, looking out for turtles," Parks told me. Now, as official, paid wildlife observers, they were forced to trade in their shorts and flip-flops for reflective vests and steel-toed boots, and there was a lot of petty griping about various bureaucratic irritations. "We had a safety training one night," Denny Kline told me when I rode along with him. "And a safety guy says: 'Don't drive the ATVs in the water! The sharks will get you.' True story. He was from Kansas."

Actual turtles wound up being spotted very rarely. Even after 50 or 60 nights of work, many of the machinery operators and BP supervisors cleaning the beaches had never seen one. Once, while out on night ops, I overheard a pudgy, young Coast Guard officer letting everyone know just this, in a snarky, what's-all-the-hassle-about kind of way. He'd just come speeding down the beach in an ATV, driving below the tide line where he could have barreled into a female loggerhead coming ashore to nest. The cleanup workers were obligated to stop work only in the *presence* of a turtle; for the most part, the turtle people had to diplomatically nudge them into doing their work in as turtle-conscious a way as was possible — they had to win their respect. "Most of them are big ol' country boys," a Share the Beach team leader named Lisa Graham said. "This is what they do: they drive tractors. But we're educating them." In fact, whenever the turtle people did actually have to bring all the machinery to a halt, and wait perhaps an hour or even two for a loggerhead to finish laying and then crawl back into the water, some of the contractors would climb down off their vehicles and sit with them, watching the mother turtle in labor, quietly enthralled. Conversion experiences were happening, Parks told me. "It's almost like, they didn't believe in turtles until then — like they didn't exist."

In late August, nearly two months after the excavation and evacuation effort began, David Godfrey, the director of the Sea Turtle Conservancy, spent a day surveying conditions around the Deepwater Horizon site with a group of government scientists. New mats of seaweed had been drifting in from the western Gulf of Mexico, replacing the sargassum that was oiled, burned or skimmed off earlier in the summer. Godfrey's party periodically hauled big clumps of it out of the water and into kiddie pools on the deck of their boat. Then they sifted through to inspect it.

"It looks pretty good," Godfrey later told me with both caution and surprise. "It looks real good, to be honest with you." There was no sign of oil, and the seaweed teemed with shrimp and other organisms. Godfrey still had nothing optimistic to say about the fate of adult sea turtles in the gulf — those that swim at depths where the oil and dispersant are potentially now concentrating, or those that subsist on jellyfish that do. The disappearance of oil from the surface of the gulf could be, in the big picture, a relatively superficial improvement. But, Godfrey explained, loggerhead hatchlings live on the surface exclusively — and more specifically on the sargassum, on which they pass around Florida and into the Atlantic. "I think they can probably make that ride safely now," he said. The government had reached the same conclusion. A few days earlier, with 28,000 eggs trucked from the Gulf Coast to the Atlantic, the relocation effort began winding down. For the remainder of the season, hatchlings have been allowed to enter the gulf.

One of the last Alabama nests shipped to Florida was handled by Sherry Sander Parks. She began excavating it early on a Friday evening but found hatchlings wriggling beneath the surface of the sand. The nest was hatching early, and the decision had been made in such situations to put a cage over the nest, wait for the turtles to break free and ship them to Florida as live hatchlings. So Parks quickly filled the nest back in with sand and called for backup: Rick Gavin, a gravelly voiced, native Alabaman known to everyone as Turtle Moses.

Before long, a rotation of turtle people had begun nest-sitting in four- and six-hour shifts, periodically escaping the heat under the shade of a house nearby. At night, Parks would slip away from working night ops to make sure that the next, fresh nest-sitters had arrived to relieve the previous ones. The vigil went on for three days and two nights before the turtles — 82 of them — finally materialized and could be loaded onto a van.

Later that night, Parks, Gavin and a few other volunteers were still camped out at the nest when two little turtles — "dawdlers" Parks called them — poked out of the sand and surprised them. The hatchlings hit the beach running, like windup toys. Parks's team let them go, watching them disappear across the tide line. "Now I feel like a turtle person again," Turtle Moses said.

Jon Mooallem is a contributing writer. He last wrote for the magazine about homosexual behavior in animals.

http://www.nytimes.com/2010/10/03/magazine/03turtles-t.html?ref=magazine

Alternative Sentencing Gaining Acceptance

Changes in attitudes, technology and finances have eroded the stance that a prison cell is the best home for every convicted criminal. Alternative sentencing is finding creative ways to deal with low-level, nonviolent offenders.

By Lewis Beale

In January, Philadelphia began to use alternative sentencing procedures for marijuana possession cases. (janp013/istockphoto)

Five years ago, when R. Seth Williams first ran for Philadelphia district attorney under the slogan "Smart On Crime, Not Just Tough," more than 50 percent of the city's felony cases were being thrown out because the DA's office simply wasn't prepared to prosecute them. Because of this, Philadelphia had the lowest conviction rate among the top 40 urban areas.

"I was looking for ways to help us reduce recidivism and use our limited resources better," Williams says, "and that doesn't mean being soft on criminals."

Williams lost that election, but last year he won on his second try, and upon assuming office in January, began to use alternative sentencing procedures for marijuana possession cases. He did this to boost the conviction rate but also to put low-level drug offenders into community service and treatment programs.

"About 95 percent of this is philosophical, and the philosophical can help us save money," Williams says. "We have 75,000 arrests annually here in Philadelphia, and 10 percent of the most serious charges are for marijuana possession, and in about 3,000 of those cases the amount is less than three grams. We're spending thousands of dollars per case to make sure they have an attorney, that they get discovery, we analyze the drug, the lights are on in the courthouse … all this for people who have about $10 worth of weed.

"So I said charge them as summary offenders [a judgment is made without a full trial], and use that time to more adequately prep the violent crime cases." Williams' office estimates this policy could eliminate 4,000 costly jury trials a year.

Williams is not the only public prosecutor going down this road. Plagued by over-crowded prisons, shrinking financial resources and indeterminate sentences for some crimes, district attorneys and federal prosecutors nationwide are looking for innovative ways in which to deal with nonviolent offenses like drug possession, crimes against property and certain white-collar crimes.

"District attorneys have always tried to divert low-level offenses," says Scott Burns, executive director of the National District Attorneys Association. "That policy is not new, but what is new is creative ways to do it. These new programs identify the low level offenders right out of the gate, and they go into fast-track programs."

As the 2008 report "One in 100: Behind Bars in America 2008" from the Pew Center for the States puts it, "… policymakers are becoming increasingly aware of research-backed strategies for community corrections — better ways to identify which offenders need a prison cell and which can be safely handled in the community, new technologies to monitor their whereabouts and behavior, and more effective supervision and treatment programs to help them stay on the straight and narrow. Taken together, these trends are encouraging policymakers to diversify their states' array of criminal sanctions with options for low-risk offenders that save tax dollars but still hold offenders accountable for their actions."

"Nonviolent drug and property crimes comprise a significant part of our prison population," adds Nicole Porter, state advocacy coordinator of The Sentencing Project. "The financial issues involved have broadened the conversation out, and introduced people to alternative means of crime control if they hadn't been looking at fiscal issues before."

Many of these programs run along similar lines. A defendant pleads guilty to a particular crime, then is instantly diverted into some sort of alternative arrangement, which could involve everything from drug treatment to job training. If the guilty party completes the program without incident, the conviction is often wiped from the books. But if they screw up, they are immediately sent to jail.

"These are intensive 18-month- to two-year programs," says Wayne McKenzie, director of the Prosecution and Racial Justice Program of the Vera Institute of Justice. "They don't just treat the addiction, but try to give these individuals social skills they might have been lacking. And when they complete the program, the felony is dismissed. If they don't complete it, there is a pre-determined sanction."

Hawaii's Project HOPE (Hawaii's Opportunity Probation with Enforcement), for example, mandates that defendants call a hotline every morning to see if they are to be drug tested that day. Random drug testing occurs at least once a week for two months, and if the defendant fails the test, fails to show up or misses an appointment with a probation officer, he or she is immediately jailed. Studies show the threat of instant incarceration has been successful in reducing drug use and crime.

Back on Track, a San Francisco program for first-time young adult drug offenders, involves job training, apprenticeships in the building trades, G.E.D. preparation, money-management skills, child care and other features. Because failure to complete the program means the defendant goes right to jail, the recidivism rate has been less than 10 percent. Back on Track costs $5,000 per year per participant, a significant reduction from the average cost to incarcerate someone, which can run anywhere from $20,000 to $40,000 or more.

At the federal level in the past decade, alternative sentencing has been used for between 15 and 25 percent of offenders, in particular those convicted for larceny, fraud and white-collar offenses. Whether these programs are popping up more in big cities, where there is more crime and more resources, or smaller venues, where there might be less of an economic incentive to make changes, is a matter of some debate.

Seth Williams feels smaller DA offices might be more receptive to innovation "because there are fewer moving parts; they are more readily addressing things on a local level. I have 600 employees and a very entrenched court system. It's easier to change the direction of a PT boat than an aircraft carrier."

But, Wayne McKenzie adds, even though small districts are adopting these programs, it's at "a much smaller rate. The numbers maybe smaller, there is less economic incentive to do so, and you might have a community still wedded to a traditional definition of prosecution. You also have to look at what are the available resources for these alternative programs, and the jurisdiction might not have the resources."

No matter. There's little doubt alternative sentencing is here to stay, and is being widely used — in the past 10 years, for example, as many as 25 percent of federal offenders have opted for incarceration alternatives. On the state and local level, Burns says, "financial concerns and budget cuts have required district attorneys and judges to think smarter — to find ways they can do it better, without the delay and the bureaucracy."

Porter adds: "Even before the recession, there was a lot of work done at the state level to try to control prison populations. There are some states that are farther along than others, and there are prosecutors looking at alternative ways to control crime and looking for new frames of thought through their offices."

http://www.miller-mccune.com/legal-affairs/alternative-sentencing-gaining-acceptance-23551/?utm_source=Newsletter129&utm_medium=email&utm_content=1005&utm_campaign=newsletters

Tracking Invasive Species from Riverside to Pandora

Plant physiologist Jodie Holt's study and management of weeds has earned her kudos in Hollywood and in academe.

By Jessica Hilo

A scene from 2009's "Avatar" depicting the planet Pandora's flora. UC Riverside professor of plant physiology Jodie Holt consulted with the filmmakers on everything from what a botanist would wear to elements of the set's design where plants were concerned.

While you may have been distracted by the whir of Navi flyers or distraught by a translucent plotline or even nauseated by your 3-D glasses, chances are if you saw James Cameron's *Avatar* last year, you spent very little time focused on its plant life.

Yet there is one unnamed Pandora player whose contributions, touted recently by the theatrical run of *Avatar*'s special edition release, whose entire 15 minutes of Hollywood acclaim came because of those fronds.

A professor of plant physiology and former chair of the department of botany and plant sciences at the University of California, Riverside, Jodie Holt was asked to be a botanical consultant for *Avatar*. In 2007, she directed actress Sigourney Weaver on how a botanist dressed, acted and approached plants, and later engaged in a series of advisory communications with *Avatar*'s set designer on botany equipment for the film.

In the fall of 2008, Holt was asked to create a number of Wikipedia-like entries for the film's suite of video game products. "The plants were surprisingly credible," Holt remarked, following that statement with some

academic grains of salt. “[But] I’m really proud that a 14-year-old playing a video game will [learn something] about plant life.”

Still, there’s more to Holt than the sensorial feast she helped to create for *Avatar*. Holt has made great strides in the study of weedy and invasive plant species.

As industrial development moves at a breakneck pace, some plants are inadvertently relocated to sites not used to hosting them. The expansion of these now new species can occur rapidly, with newer plants taking over territory at the expense of their native counterparts. “From the very beginning, the thing I’ve been most interested in is the plants’ interaction with their environment,” said Holt, adding, “Weeds are plants out of place.”

UC Riverside professor of plant physiology Jodie Holt.

In the first part of her career, Holt focused on weed growth in agriculture, coauthoring the book, *Ecology of Weeds and Invasive Plants: Relationship to Agriculture and Natural Resource Management*.

This book discussed weed and invasive plant development, as well as ecologically sound weeding of exotic species.

Holt’s research has since evolved to study invasive species in wild areas where commercial weeding practices are not viable. The challenge in eliminating invasive species from these environments comes not only in classifying invasive species, as some exotic plants have been around for generations, but also in extracting weeds without harming endangered plants and animals.

“You can’t just grab a spray in the wildlands,” Holt said. “It becomes a matter of elimination with plows and bush rakes.”

Much of Holt’s current work surrounds invasive species in riparian environments: studying conditions that establish growth, repress growth and prevent reinvasion. Holt is particularly interested in the giant reed or arundo, an Asian native that flourishes along the western coast of the United States.

“As with all the sciences,” Holt said, the study of invasive species often lacks the money to manage invaders in remote areas or to pay for research staff — “especially when the work is not important to the masses.”

But getting word to the masses, she believes, is important for scientists. "You have to learn how to be approachable. There used to be a real divide between researchers in their lab coats and glasses to now. [Scientists now] all have branches that deal with outreach. It's an essential function in science today."

For her part, Holt has woven education and outreach into her study. A fellow of both the American Association for the Advancement of Science and the Weed Science Society of America, she has served as an associate editor of the journal *Invasive Plant Science and Management*, and she was honored in the 2008-09 academic year with UCR's Distinguished Teaching Award. Earlier this month, the San Diego Botanic Gardens presented her with the Paul Ecke Jr. Award of Excellence.

This award was established by the San Diego Botanic Garden in 2002 and recognizes exceptional achievements by an individual or group for contributions made in education, conservation, creation of preservation of public spaces and preservation or re-creation of historically significant plantings and structures.

http://www.miller-mccune.com/science/tracking-invasive-species-from-riverside-to-pandora-23589/

CSI: Pompeii

The ancient Romans of Pompeii were already parboiled when the lava arrived, according to a new investigation with scary implications for modern-day Naples.

By Michael Haederle

A depiction of the Mt. Vesuvius eruption from the BBC's "Pompeii: The Last Day." The city's victims were already dead from pyroclastic surges when the lava arrived, according to a new study. (Wikipedia.org)

Ever since 19th-century archaeologists started making plaster casts of the fallen inhabitants of Pompeii, it has been assumed they died from suffocation as a thick layer of ash fell on the town following a massive eruption of nearby Mt. Vesuvius in 79 A.D.

But a new report from a team of Italian scientists tells a very different tale about what happened to the residents of the Roman town, and it has important implications for the 3 million people who today live around the world's most dangerous volcano.

A meticulous study of bones, household objects and other evidence — a little like a *CSI* investigation of a 1,900-year-old cold case — suggests that the victims died suddenly in an intense blast of fine ash and

superheated gas called a pyroclastic surge, says Giuseppe Mastrolorenzo, a senior researcher at the Vesuvius Observatory in Naples.

"Impact and suffocation were not important," he says. "The victims were killed by the high temperatures."

The deadly surge passed through Pompeii, a little over 6 miles from Vesuvius, at a speed of around 40 mph, instantly raising temperatures to 500 degrees Fahrenheit and causing sudden death, Mastrolorenzo says. The victims were found in postures characteristic of cadaveric spasm, in which the muscles stiffen at the moment of death, according to the study.

Ominously, the lethal effects of a succession of six pyroclastic surges from the eruption extended more than 12 miles from Vesuvius. The findings were reported in "Lethal Thermal Impact at Periphery of Pyroclastic Surges: Evidences at Pompeii," published online at the *PLoS One* website.

At the time of the eruption, Pompeii was a thriving seaside town of about 15,000-20,000 on the Gulf of Naples. Even then, the surrounding region of Campania, which had been blanketed by ash from eruptions going back thousands of years, was densely populated due to the mineral-rich volcanic soil.

At midday on Aug. 24, 79 A.D., earthquakes and belching ash from the volcano presaged the impending eruption. "At least 90 percent of the people were able to evacuate in the early phase of the eruption," Mastrolorenzo says. But for unknown reasons, about 1,000 people remained behind (calling to mind those who decided to stay in New Orleans as Hurricane Katrina bore down).

The first three surges from the volcano did not reach Pompeii, although there was a heavy ash fall, sufficient to cause some building roofs to collapse, Mastrolorenzo says.

Although they did not know it, the remaining residents were already doomed. As the layer of ash grew thicker, it became harder to move about ("It's like walking on snow," Mastrolorenzo says). Even worse, visibility had declined to almost zero. "Probably they had no idea in which direction to escape because everything was in complete darkness," Mastrolorenzo says.

After the deadly fourth surge passed through early the next morning, two final surges blanketed the town in meters of ash, burying it so deeply that later generations forgot it had ever existed.

Pompeiians had no concept of what a volcanic eruption was because none had happened in their living memory. "At the first moment, they probably confused the eruption with a storm or a fire on the mountain," he says. "They could not imagine that a quiet mountain like Vesuvius could change so abruptly."

Mastrolorenzo believes people living in the region today are not much different. The last eruption occurred in 1944, during World War II, meaning most residents are too young to remember it, he says.

Although a network of sensors continually monitors ground deformation, gas composition and gravity changes, scientists would not be able to predict exactly when the volcano might blow even if the pattern of activity began to pick up. And, as the new study shows, Vesuvius can kill with terrifying speed.

An evacuation plan exists on paper, but it has not been updated recently and makes unwarrantedly optimistic predictions, Mastrolorenzo says. Meanwhile, the last time authorities tried to simulate an evacuation (with just

1,800 residents), the buses that were supposed to be ferrying them to safety stalled in heavy traffic. (Again, reminiscent of New Orleans and Hurricane Katrina.)

"This is a major problem in mitigation," he says – basically, residents and civil authorities don't take the threat posed by Vesuvius seriously enough. "I'm studying why the common tendency is to be optimistic."

Mastrolorenzo has also studied the powerful Avellino eruption of 3,780 years ago, which scattered the Bronze Age inhabitants of the Campanian plain and rendered the area around Vesuvius uninhabitable for hundreds of years. And he warns that the western suburbs of Naples are built atop Campei Flegrei, a collapsed volcanic caldera that in the past has seen "super eruptions" — large enough to cause global climate change.

Shockingly, he says, no contingency plans exist should Campei Flegrei become active once more. He blames the city's citizens as much as public officials.

"There is no interest," he says, "because they prefer to care about everyday activity."

http://www.miller-mccune.com/science/csi-pompeii-19951/

Rocky Mountain Dust-up: Runoff's Dirty Secret

The dust on high peaks, blown in from Southwestern pastures, farms, mining roads and off-road vehicle parks, is hastening snowmelt and reducing the runoff into the Colorado River, scientists say.

By Melinda Burns

Snow pits like this one, dug in the mountains of the Upper Colorado River basin, were used to study the layering of dust in snowfields and its impact on the absorption of sunlight. (Center for Snow and Avalanche Studies) Related Stories

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Every time the winds blow east from the deserts of the Southwest, it means less water for 27 million people who depend on the Colorado River.

Layers of dust form every year on snowfields in the Rocky Mountains, blown in from pastures, farms, dirt roads and off-road vehicle parks. For decades, according to a study released this week by the National

Academy of Sciences, this dust on snow both accelerates the annual runoff by weeks and reduces what reaches the Colorado River by 5 percent.

Clean snow reflects about 80 percent of the sunlight that hits it. But in the high Rockies, dust on snow absorbs heat from the sun, dropping reflectivity to just 33 percent, said Thomas Painter, the lead researcher for the study and a snow hydrologist at the University of California, Los Angeles, and NASA's Jet Propulsion Laboratory.

"The dust is doubling the load of sun going into the snow pack," Painter said. "It's so effective at melting down the clean snow underneath it and on top of it."

The dust, which looks like dirt, can fool the eye, too.
"It can look like a desert," Painter said. "It really looks like you're skiing on sand dunes. It's stunning. At times, we would get a little confused."

In all, the scientists found, 35 billion cubic feet of Colorado River runoff — Los Angeles's water use every 18 months — is lost each year because of dust on snow. They estimate that the loss goes back 80 years. While this is bad for humans, 75-year-old rules on using the open range have helped; today, there is five times as much dust on snow in the Rockies as in the mid-1800s, down from six times as much at the turn of the 20th century.

Previously, Painter co-authored a study of mud cores from mountain lakes showing that dust in the Rockies increased six-fold between the mid-1800s and the early 20th century, as settlers trooped into the Southwest with their livestock and plows. The cattle and the farmers disturbed the delicate desert crust and left it vulnerable to blowing in the wind.

Tom Painter is pictured tracking radiation in June 2007. In melting snow, dust comes to light. (Center for Snow and Avalanche Studies)
The new study is the first to quantify the effects of dust on snow on the scale of an entire river basin. It shows, too, that dust is far more damaging to runoff than the soot that blows into the Rockies from coal-fired power plants in the region.

Steven Fassnacht, a Colorado State University snow hydrologist who has studied dust on snow in Spain and Antarctica as well as the American West, called the findings of Painter's team "ground-breaking and important." Although the study did not look at how dust changes the surface of snow (it makes it smoother), these effects would not likely change the overall conclusions, Fassnacht said. The team's methodology "should be applicable anywhere in the world," he said.

Experiments on the rate of snowmelt date back to Ben Franklin, the American statesman better known for kites and keys. He placed pieces of colored fabric on snow, and he found that the snow melted fastest under the darkest cloths.

Because it is dark, dust on snow causes more snow to evaporate, and faster. (A similar concern about soot from oceangoing vessels concerns those watching Arctic ice decline.)

Specifically, the snow pack in the Rockies melts three weeks earlier than it did decades ago, Painter and his colleagues found. The earlier melt exposes the underlying plants, which then draw up water and exhale it into the atmosphere. Three more weeks of that plant activity accounts for most of the runoff loss.

Jeff Dozier, a snow hydrologist at the University of California, Santa Barbara, who reviewed the NASA-led paper for publication, said the highlight of the report was that three-week calculation for earlier snow melt.

“This is a real advance,” he said. “That’s probably occurring in other places of the world.”

For the study, a team of six scientists from NASA, the U.S. Geological Survey, the National Snow and Ice Data Center of Boulder, Colo., the Center for Snow and Avalanche Studies of Silverton, Colo., and the University of Washington collected snow samples at various levels. They measured the reflectivity of the snow and the balance of energy coming in and going out. They used advanced hydrology models, and they compared the present to the past.

The Colorado River supplies water to seven states — Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming — and the supply is already overcommitted. Compounding the problems for water managers, the snow is melting more often in the spring, not in the summer, when farms and cities need it the most.
Twelve dust layers shown in a study plot in Colorado's Senator Beck Basin Study Area. (Center for Snow and Avalanche Studies)
Over the years, drought, wildfire, off-road vehicle parks and dirt roads for oil and gas exploration, in addition to grazing and farming, have contributed to the layers of dust on Rocky Mountain snowfields, the scientists said. Unless steps are taken to curb the dust and help prolong snow cover, they said, more runoff could be lost as the region gets drier. Up to 20 percent of Colorado River flow could be lost by 2050 because of climate change, scientists say.

Compared to the challenge of high-level international negotiations over greenhouse gas emissions, the study said, dealing with man-made disturbances in the Southwest high desert would be a relatively easy way to cushion water shortages from the Colorado River.

It’s been shown before that regulation (as well as progressive grazing practices) can help keep the dust down. The Taylor Grazing Act of 1934, which required permits for grazing on public lands, effectively reduced the amount of dust falling in the Rockies by 25 percent.

http://www.miller-mccune.com/environment/rocky-mountain-dust-up-runoffs-dirty-secret-23223/

Suburban Trail Use Not a Sure Thing

The mere existence of a walking or biking trail near your neighborhood doesn't mean anyone is using it, researchers and trail advocates have discovered.

By John McKinney

If you build it, they may not come, researchers and trail advocates have discovered. (Wyoming Valley Wellness Trails Partnership)

For decades a walking/biking trail near a suburb has been considered a universal good: the most preferred amenity (more so than golf courses and tennis courts) of suburbanites and regarded as a major contributor to good health and fitness. Studies have shown that a location near a trail increases property values and even suggested that homebuyers are drawn to a specific neighborhood by the proximity of a pathway.

"Build it and they will come," is a core conviction of suburban trail builders and policymakers alike from Fullerton, Calif., to Farmington, Conn. New research, however, casts that fundamental belief into doubt.

A study of a Salt Lake suburb pathway by University of California, Santa Barbara, researchers Konstadinos G. Goulias and Shaunna K. Burbidge presents an altogether different view of trail use in the 'burbs: "Simply installing a paved path where there was not one before does not induce demand for physical activity."

The study, published in the *Transportation Research Record: Journal of the Transportation Research Board*, found that residents of West Valley City did not increase levels of walking and cycling after a new trail was constructed nearby.

Goulias, a transportation engineering and planning consultant for projects worldwide, expected the installation of a suburban trail would trigger an increase in physical activity levels of neighborhood residents. "We expected at least a few persons to be influenced by the new trail and to tell us what a great opportunity it was for biking and walking."

One unique aspect of the study was its "before-and-after" approach — it measured the neighbors' walking-jogging-cycling frequency before the trail was built and after it was completed. About 87 percent of those who used the new trail reported they were pursuing these activities before the path was constructed and used sidewalks or more distant trails. Proximity to the trail had no significant effect on total physical activity; those near it were no more likely to use it than those farther away.

Other research suggests that using a suburban trail must be "sold" to foot-dragging neighbors. While motivating people to walk and bike is a difficult task in all communities, it is a particular challenge in the automobile-centered suburbs.

"We found we had to do a lot of marketing to get people to use the trails,"

explains Michele Schasberger of the Wyoming Valley Wellness Trails Partnership. Schasberger directed a five-year-long project to increase physical activity among residents in northeastern Pennsylvania by expanding a trail network; the results appeared in the *American Journal of Preventative Medicine*.

Funded by an Active Living by Design grant from the Robert Wood Johnson Foundation, the partnership constructed 22 miles of trail in the city of Wilkes-Barre and other communities along the Susquehanna River. "The biggest lesson we learned from the grant is the power of promotion and the importance of informing the public — not just once, but frequently — about trails," Schasberger says.

Telling potential Pennsylvania pedestrians to take a walk because it's good for them was not a successful approach to boosting trail use, according to Schasberger. Instead,

the trail partnership found that community members were more likely to be motivated to get off the couch and onto the trail by messages about fresh air and fun times with friends and family.

Media efforts, cookouts, organized walks and bike rides were employed to successfully boost trail use. Infrared trail counters recorded a 40 percent increase on the Greater Hazleton Rail Trail during a yearlong effort to promote that path.

Researchers admit that the aesthetics of a trail may have something to do with its usage. People might be more inclined to a walk in the woods rather than an amble along an aqueduct. A generic trail installed "just for exercise" is likely not as attractive to users as one leading through a lovely park or one that links up interesting sights.

"Aesthetics matter, but it's really connectivity that's most important," states Barbara Rice, program manager for the National Park Service's Rivers, Trails and Conservation Assistance Program.

Rice and her colleagues, who oversee hundreds of trail projects across the United States, stresses that they are more concerned about the quality of trails than quantity. "The best trail, and the ones likely to receive the most use, are ones that connect users to something desirable — to nature, to special places in the community, to other people."

While research may have refuted a sacred belief — "Build the paths and they will come" — it has not yet established what motivates suburbanites or anyone else to hit the trail. Goulias strongly suggests making some major investments in better understanding the behavior of those who use trails and those who do not.

National Parks Trails advocate Rice agrees. "We need to measure our success not so much by the number of miles of trails we build, but by the number of people we're able to encourage to use them."

http://www.miller-mccune.com/health/suburban-trail-use-not-a-sure-thing-23555/

Newly Discovered DNA Repair Mechanism

Graduate student Emily Rubinson sitting in front of computer screen displaying a microphotograph of crystals of the AlkD enzyme. Figuring out how to crystallize proteins is a key step in the process of determining their molecular structure. (Credit: Joe Howell)

ScienceDaily (Oct. 5, 2010) — Tucked within its double-helix structure, DNA contains the chemical blueprint that guides all the processes that take place within the cell and are essential for life. Therefore, repairing damage and maintaining the integrity of its DNA is one of the cell's highest priorities.

Researchers at Vanderbilt University, Pennsylvania State University and the University of Pittsburgh have discovered a fundamentally new way that DNA-repair enzymes detect and fix damage to the chemical bases that form the letters in the genetic code. The discovery is reported in an advanced online publication of the journal *Nature* on Oct. 3.

"There is a general belief that DNA is 'rock solid' -- extremely stable," says Brandt Eichman, associate professor of biological sciences at Vanderbilt, who directed the project. "Actually DNA is highly reactive."

On a good day about one million bases in the DNA in a human cell are damaged. These lesions are caused by a combination of normal chemical activity within the cell and exposure to radiation and toxins coming from environmental sources including cigarette smoke, grilled foods and industrial wastes.

"Understanding protein-DNA interactions at the atomic level is important because it provides a clear starting point for designing drugs that enhance or disrupt these interactions in very specific ways," says Eichman. "So it could lead to improved treatments for a variety of diseases, including cancer."

The newly discovered mechanism detects and repairs a common form of DNA damage called alkylation. A number of environmental toxins and chemotherapy drugs are alkylation agents that can attack DNA.

When a DNA base becomes alkylated, it forms a lesion that distorts the shape of the molecule enough to prevent successful replication. If the lesion occurs within a gene, the gene may stop functioning. To make matters worse, there are dozens of different types of alkylated DNA bases, each of which has a different effect on replication.

One method to repair such damage that all organisms have evolved is called base excision repair. In BER, special enzymes known as DNA glycosylases travel down the DNA molecule scanning for these lesions. When they encounter one, they break the base pair bond and flip the deformed base out of the DNA double helix. The enzyme contains a specially shaped pocket that holds the deformed base in place while detaching it without damaging the backbone. This leaves a gap (called an "abasic site") in the DNA that is repaired by another set of enzymes.

Human cells contain a single glycosylase, named AAG, that repairs alkylated bases. It is specialized to detect and delete "ethenoadenine" bases, which have been deformed by combining with highly reactive, oxidized lipids in the body. However, AAG also handles many other forms of akylation damage. Many bacteria, however, have several types of glycosylases that handle different types of damage.

"It's hard to figure out how glycosylases recognize different types of alkylation damage from studying AAG since it recognizes so many," says Eichman. "So we have been studying bacterial glycosylases to get additional insights into the detection and repair process."

That is how they discovered the bacterial glycosylase AlkD with its unique detection and deletion scheme. All the known glycosylases work in basically the same fashion: They flip out the deformed base and hold it in a special pocket while they excise it. AlkD, by contrast, forces both the deformed base and the base it is paired with to flip to the outside of the double helix. This appears to work because the enzyme only operates on deformed bases that have picked up an excess positive charge, making these bases very unstable. If left alone, the deformed base will detach spontaneously. But AlkD speeds up the process by about 100 times. Eichman speculates that the enzyme might also remain at the location and attract additional repair enzymes to the site.

AlkD has a molecular structure that is considerably different from that of other known DNA-binding proteins or enzymes. However, its structure may be similar to that of another class of enzymes called DNA-dependent kinases. These are very large molecules that possess a small active site that plays a role in regulating the cells' response to DNA damage. AlkD uses several rod-like helical structures called HEAT repeats to grab hold of DNA. Similar structures have been found in the portion of DNA-dependent kinases with no known function, raising the possibility that they play an additional, unrecognized role in DNA repair.

The new repair mechanism may also prove to be the key to understanding the differences in the way that the repair enzymes identify and repair toxic and mutagenic lesions. That is important because mutagenic lesions that the repair mechanisms miss are copied to daughter cells and so can spread whereas the deleterious effects of toxic lesions are limited to the original cell.

Understanding these differences could lead to more effective chemotherapy agents, Eichman points out. These drugs are strong alkylating agents designed to induce lesions in a cancer patient's DNA. Because cancer cells are reproducing more rapidly than the body's normal cells, the agent kills them preferentially. However, in addition to toxic lesions that kill the cell, the agent also produces lesions that cause mutations, which can lead to additional complications. Additionally, the efficacy of these drugs is low because they are working against the body's repair mechanisms. If it were possible to design a chemo drug that predominantly creates toxic lesions, however, it should be more effective and have fewer harmful side-effects. Alternatively, if we understood how glycosylases recognize alkylation damage, it may be possible to design a drug that specifically inhibits repair of toxic, but not mutagenic lesions.

Vanderbilt graduate student Emily H. Rubinson, A.S. Prakasha Gowda and Thomas E. Spratt from Pennsylvania State University College of Medicine and Barry Gold from the University of Pittsburgh

contributed to the study, which was supported by grants from the American Cancer Society, National Institutes of Health and U.S. Department of Energy.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Vanderbilt University**. The original article was written by David F. Salisbury.

Journal Reference:

1. Emily H. Rubinson, A. S. Prakasha Gowda, Thomas E. Spratt, Barry Gold, Brandt F. Eichman. **An unprecedented nucleic acid capture mechanism for excision of DNA damage**. *Nature*, 2010; DOI: 10.1038/nature09428

http://www.sciencedaily.com/releases/2010/10/101004112156.htm

New Language Identified in Remote Corner of India; One of Thousands of Endangered Tongues Around World

Kachim, a speaker of the hidden language Koro, talks to National Geographic Fellow Gregory Anderson. Anderson and a team made the first known recordings of Koro, an endangered language that is new to science. The expedition is featured in a new National Geographic book, "The Last Speakers," by K. David Harrison. (Credit: Photo by Chris Rainier)

ScienceDaily (Oct. 5, 2010) — Linguists reporting from a National Geographic expedition to India's remote northeast corner have identified a language completely new to science.

The language, known as Koro, belongs to the Tibeto-Burman language family, a group of some 400 languages that includes Tibetan and Burmese, the linguists said. Although some 150 Tibeto-Burman languages are spoken in India alone, the expedition team has been unable to identify any language closely related to Koro, so distinct is it from the others in the family.

The expedition was part of National Geographic's Enduring Voices project (http://on.natgeo.com/dDyLox), led by National Geographic Fellows Gregory Anderson and K. David Harrison. Before the expedition, the team had targeted the remote Arunachal Pradesh state in northeastern India as one of its "Language Hotspots" -- a place on the world map that hosts a rich diversity of languages, many unwritten, that are little studied or documented.

"On a scientist's tally sheet, Koro adds just one entry to the list of 6,909 languages worldwide…. But Koro's contribution is much greater than that tiny fraction would suggest," Harrison writes in "The Last Speakers," newly published by National Geographic Books. "Koro brings an entirely different perspective, history,

mythology, technology and grammar to what was known before." A scientific paper on the newly identified language will be published in volume 71 of the journal Indian Linguistics.

The revelation of the new language was bittersweet: Koro is highly endangered. Only about 800 people are believed to speak it -- few under age 20 -- and the language has not been written down. "We were finding something that was making its exit, was on its way out," Anderson said. "And if we had waited 10 years to make the trip, we might not have come across close to the number of speakers we found."

Arunachal Pradesh is considered a "black hole" on the linguistic map: Because a special permit is required to enter the region, few linguists have worked there, and no one has drawn up a reliable list of languages spoken there, their locations or numbers of speakers.

The Enduring Voices team began its search in Arunachal Pradesh in 2008 for two poorly known languages -- Aka and Miji -- known to be spoken in one small district. The team, which included Indian linguist Ganesh Murmu of Ranchi University, climbed steep hillsides to reach speakers' villages, going door-to-door among the bamboo houses that sit on stilts; villagers eke out livings raising pigs and cultivating rice and barley.

As they listened to and recorded the vocabularies of these poorly known tongues, Harrison, Anderson and Murmu began to detect a surprise third language, one locally known as Koro. None of the scientific literature they had studied had reported the existence of a third and completely distinct language in the region -- it's not listed in standard international registries of languages or even in Indian language surveys or censuses.

"We didn't have to get far on our word list to realize it was extremely different in every possible way," Harrison said.

To reach the tiniest Koro village, the team crossed a rushing mountain river by bamboo raft. They sat on shaded verandas of the stilt-supported houses, making recordings as people shared their vocabularies and life stories in the hidden language of Koro. Thousands of words were captured -- the first known time that Koro was recorded as its own distinct language, Harrison said.

Koro shaped up as distinct from the region's other languages on many levels, the linguists said. Its inventory of sounds was completely different, and so was the way sounds combine to form words. Words also are built differently in Koro, as are sentences.

For example, the Aka word for "mountain" is "phù" while the Koro word is "nggõ." Aka speakers call a pig a "vo" while to Koro speakers, a pig is a "lele."

"Koro could hardly sound more different from Aka," Harrison writes in "The Last Speakers." "They sound as different as, say, English and Japanese."

Strangely, the Aka and Koro speakers didn't seem to see -- or hear -- it that way. Aka speakers considered their Koro-speaking neighbors and cousins as speaking a dialect of the same language as they did.

Anderson and Harrison said that Aka is the traditional language of the region's historic slave traders; they hypothesize that Koro may have sprung from the slaves, though they say more study is needed to determine precise origins.

Languages are dying around the world; one blinks out about every two weeks. Linguists consider about half of the world's nearly 7,000 tongues are endangered, the victims of cultural changes, ethnic shame, government repression and other factors.

National Geographic's Enduring Voices project works to identify language hotspots, document vanishing languages and cultures, and assist with language revitalization. Harrison, an associate professor of linguistics at Swarthmore College, and Anderson, director of the Living Tongues Institute for Endangered Languages, work with National Geographic Fellow and photographer Chris Rainier on the effort.

What is the value to the speakers of identifying the world's "hidden" languages? "Part of the uniqueness of very small languages is that their speakers may feel a sense of ownership over them," Harrison writes in "The Last Speakers." "In the case of Koro, even though they seem to be gradually giving up their language, it remains the most powerful trait that identifies them as a distinct people. Without it, they are merely part of a larger group within India's population of a billion-plus."

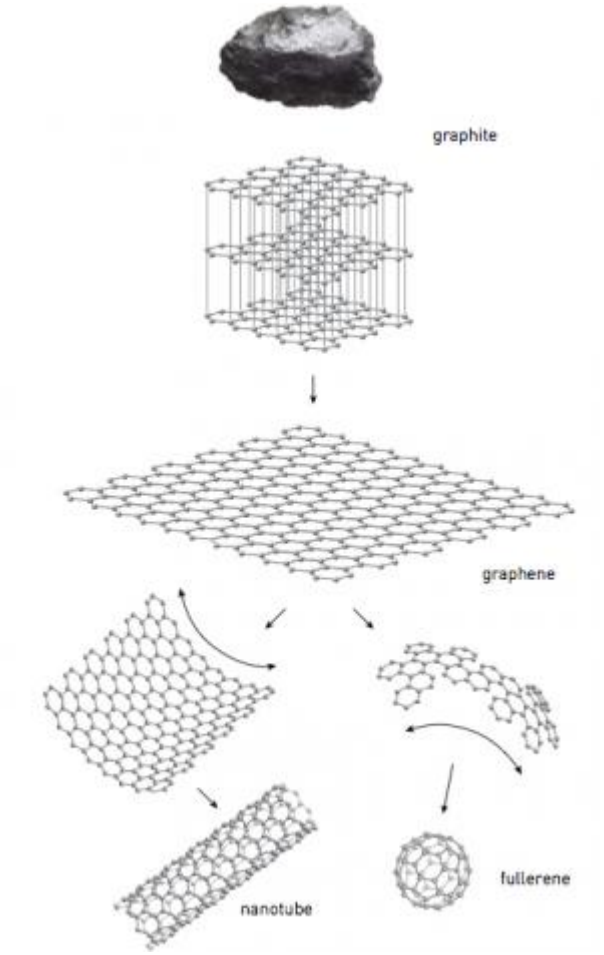
The National Geographic Enduring Voices scientific team will return to India in November to continue studying this enigmatic, newly classified language.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **National Geographic Society**.

http://www.sciencedaily.com/releases/2010/10/101005133339.htm

Nobel Prize in Physics 2010 for Graphene -- 'Two-Dimensional' Material



Graphene from graphite: Graphite is a basic material found in nature. When taken apart graphite sheets become graphene. A rolled up layer of graphene forms a carbon nanotube, folded up it becomes a small football, fullerene. Hidden inside graphite, graphene was waiting to be discovered. (Credit: © Airi Iliste/The Royal Swedish Academy of Sciences)

ScienceDaily (Oct. 5, 2010) — The Royal Swedish Academy of Sciences has awarded the Nobel Prize in Physics for 2010 to Andre Geim and Konstantin Novoselov, both of the University of Manchester, "for groundbreaking experiments regarding the two-dimensional material graphene."

A thin flake of ordinary carbon, just one atom thick, lies behind this year's Nobel Prize in Physics. Geim and Novoselov have shown that carbon in such a flat form has exceptional properties that originate from the remarkable world of quantum physics.

Graphene is a form of carbon. As a material it is completely new -- not only the thinnest ever but also the strongest. As a conductor of electricity it performs as well as copper. As a conductor of heat it outperforms all other known materials. It is almost completely transparent, yet so dense that not even helium, the smallest gas atom, can pass through it. Carbon, the basis of all known life on earth, has surprised us once again.

Geim and Novoselov extracted the graphene from a piece of graphite such as is found in ordinary pencils. Using regular adhesive tape they managed to obtain a flake of carbon with a thickness of just one atom. This at a time when many believed it was impossible for such thin crystalline materials to be stable.

However, with graphene, physicists can now study a new class of two-dimensional materials with unique properties. Graphene makes experiments possible that give new twists to the phenomena in quantum physics. Also a vast variety of practical applications now appear possible including the creation of new materials and the manufacture of innovative electronics. Graphene transistors are predicted to be substantially faster than today's silicon transistors and result in more efficient computers.

Since it is practically transparent and a good conductor, graphene is suitable for producing transparent touch screens, light panels, and maybe even solar cells.

When mixed into plastics, graphene can turn them into conductors of electricity while making them more heat resistant and mechanically robust. This resilience can be utilised in new super strong materials, which are also thin, elastic and lightweight. In the future, satellites, airplanes, and cars could be manufactured out of the new composite materials.

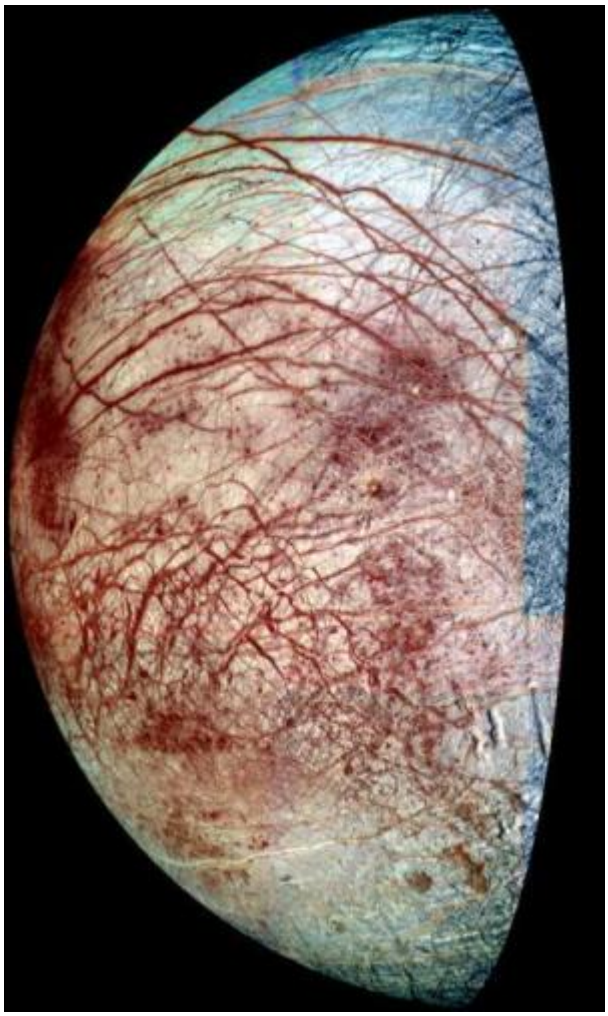
This year's Laureates have been working together for a long time now. Konstantin Novoselov, 36, first worked with Andre Geim, 51, as a PhD-student in the Netherlands. He subsequently followed Geim to the United Kingdom. Both of them originally studied and began their careers as physicists in Russia. Now they are both professors at the University of Manchester.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Nobel Foundation**.

http://www.sciencedaily.com/releases/2010/10/101005085507.htm

Europa's Hidden Ice Chemistry: Jupiter's Moon May Have More Than Possible Ocean



The icy surface of Europa is shown strewn with cracks, ridges and "chaotic terrain," where the surface has been disrupted and ice blocks have moved around. New laboratory experiments show that water ice and frozen sulfur dioxide react even at the frigid temperatures of Europa. Because the reaction occurs without the aid of radiation, it could take place throughout the moon's thick ice layer -- an outcome that would revamp current thinking about the chemistry and geology of this moon and perhaps others. (Credit: NASA/JPL/University of Arizona)

ScienceDaily (Oct. 4, 2010) — The frigid ice of Jupiter's moon Europa may be hiding more than a presumed ocean: it is likely the scene of some unexpectedly fast chemistry between water and sulfur dioxide at extremely cold temperatures.

Although these molecules react easily as liquids -- they are well-known ingredients of acid rain -- Mark Loeffler and Reggie Hudson at NASA's Goddard Space Flight Center in Greenbelt, Md., now report that they react as ices with surprising speed and high yield at temperatures hundreds of degrees below freezing. Because the reaction occurs without the aid of radiation, it could take place throughout Europa's thick coating

of ice -- an outcome that would revamp current thinking about the chemistry and geology of this moon and perhaps others.

"When people talk about chemistry on Europa, they typically talk about reactions that are driven by radiation," says Goddard scientist Mark Loeffler, the first author on the paper being published Oct. 2 in *Geophysical Research Letters*. That's because the moon's temperature hovers around 86 to 130 Kelvin, or about -300 to -225 °F. In this extreme cold, most chemical reactions require an infusion of energy from radiation or light. On Europa, the energy comes from particles from Jupiter's radiation belts. Because most of those particles penetrate just fractions of an inch into the surface, models of Europa's chemistry typically stop there.

"Once you get below Europa's surface, it's cold and solid, and you normally don't expect things to happen very fast under those conditions," explains co-author Reggie Hudson, the Associate Lab Chief of Goddard's Astrochemistry Laboratory.

"But with the chemistry we describe," adds Loeffler, "you could have ice 10 or 100 meters [roughly 33 or 330 feet] thick, and if it has sulfur dioxide mixed in, you're going to have a reaction."

"This is an extremely important result for understanding the chemistry and geology of Europa's icy crust," says Robert E. Johnson, who is an expert on radiation-induced chemistry on planets and is the John Lloyd Newcomb Professor of Engineering Physics at the University of Virginia in Charlottesville.

From remote observations, astronomers know that sulfur is present in Europa's ice. Sulfur originates in the volcanoes of Jupiter's moon Io, then becomes ionized and is transported to Europa, where it gets embedded in the ice. Additional sulfur might come from the ocean that's thought to lie beneath Europa's surface. "However," says Johnson, "the fate of the implanted or any subsurface sulfur is not understood and depends on the geology and chemistry in the ice crusts."

In experiments that simulated the conditions on Europa, Loeffler and Hudson sprayed water vapor and sulfur dioxide gas onto quarter-sized mirrors in a high-vacuum chamber. Because the mirrors were kept at about 50 to 100 Kelvin (about -370 to -280 °F), the gases immediately condensed as ice. As the reaction proceeded, the researchers used infrared spectroscopy to watch the decrease in the concentrations of water and sulfur dioxide and the increase in the concentrations of positive and negative ions generated.

Despite the extreme cold, the molecules reacted quickly in their icy forms. "At 130 Kelvin [about -225 °F], which represents the warm end of the expected temperatures on Europa, this reaction is essentially instantaneous," says Loeffler. "At 100 Kelvin, you can saturate the reaction after half a day to a day. If that doesn't sound fast, remember that on geologic timescales -- billions of years -- a day is faster than the blink of an eye."

To test the reaction, the researchers added frozen carbon dioxide, aka dry ice, which is commonly found on icy bodies, including Europa. "If frozen carbon dioxide had blocked the reaction, we wouldn't be nearly as interested," explains Hudson, "because then the reaction probably wouldn't be relevant to Europa's chemistry. It would be a laboratory curiosity." But the reaction continued, which means it could be significant on Europa as well as Ganymede and Callisto, two more of Jupiter's moons, and other places where both water and sulfur dioxide are present.

The reaction converted one-quarter to nearly one-third of the sulfur dioxide into product. "This is an unexpectedly high yield for this chemical reaction," says Loeffler. "We would have been happy with five

percent." More importantly, the positive and negative ions produced will react with other molecules. This could lead to some intriguing chemistry, especially because bisulfite (HSO_3^-), a type of sulfur ion, and some other products of this reaction are refractory -- stable enough to stick around for a while.

Robert Carlson, who is a senior research scientist at NASA's Jet Propulsion Laboratory in Pasadena, Calif., and collaborates with the two researchers, notes that earlier hints of water and sulfur dioxide reacting as solids were found but not explained. "The Loeffler and Hudson results show that really interesting acid-base reactions are going on," he says. "I am anxious to see what might happen when other species are added and how the minor concentrations of sulfur dioxide on the satellite surfaces affect the overall chemistry."

The ultimate test of the laboratory experiments will be whether evidence of any reaction products can be found in data collected during remote observations or future visits to Europa. Johnson agrees that if subsurface sulfur dioxide on Europa "reacts to form refractory species, as [the researchers] indicate, then the picture changes completely. This not only will affect our understanding of Europa but also will affect the models used to develop instruments for the proposed Jupiter-Europa Orbiter mission."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **NASA/Goddard Space Flight Center**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Mark J. Loeffler, Reggie L. Hudson. **Thermally-induced chemistry and the Jovian icy satellites: A laboratory study of the formation of sulfur oxyanions**. *Geophysical Research Letters*, 2010; 37 (19) DOI: 10.1029/2010GL044553

http://www.sciencedaily.com/releases/2010/10/101004211646.htm

First Census of Marine Life Shows Ocean Life Is Richer, More Connected, More Altered Than Expected

Pandeopesis ikarii -- a species of zooplankton found on the Inner Space Speciation Project to the Celebes Sea, October 2007 (Credit: Russ Hopcroft -- University of Alaska Fairbanks & Census of Marine Life)

ScienceDaily (Oct. 5, 2010) — After a decade of joint work and scientific adventure, marine explorers from more than 80 countries delivered a historic first global Census of Marine Life.

In one of the largest scientific collaborations ever conducted, more than 2,700 Census scientists spent over 9,000 days at sea on more than 540 expeditions, plus countless days in labs and archives.

Released Oct. 4 are maps, three landmark books, and a highlights summary that crown a decade of discovery.

The now-completed documentation in books and journals, plus the accumulating databases and established websites, videos, and photo galleries report and conclude the first Census. Over the decade more than 2,600 academic papers were published -- one, on average, every 1.5 days.

Presented is an unprecedented picture of the diversity, distribution, and abundance of all kinds of marine life in Planet Ocean -- from microbes to whales, from the icy poles to the warm tropics, from tidal near shores to the deepest dark depths.

Oceanic diversity is demonstrated by nearly 30 million observations of 120,000 species organized in the global marine life database of the Census, the Ocean Biogeographic Information System (OBIS). The migrations tracked across seas and up and down in the water column, plus the revealed ubiquities of many species, demonstrate connections among oceans. Comparisons of the present ocean with the bountiful ocean life portrayed in old archives document changes. The Census established declines -- and some recoveries -- of marine abundance.

The OBIS directory of names and addresses of known ocean species establishes a reference against which humanity can monitor 21st century change. It also delineates the vast areas of ocean that have never been explored.

"We prevailed over early doubts that a Census was possible, as well as daunting extremes of nature," says Australian Ian Poiner, chair of the Census Steering Committee. "The Age of Discovery continues."

"This cooperative international 21st century voyage has systematically defined for the first time both the known and the vast unknown, unexplored ocean."

According to Dr. Poiner, the beauty, wonder, and importance of marine life are hard to overstate.

"All surface life depends on life inside and beneath the oceans. Sea life provides half of our oxygen and a lot of our food and regulates climate. We are all citizens of the sea. And while much remains unknown, including at least 750,000 undiscovered species and their roles, we are better acquainted now with our fellow travelers and their vast habitat on this globe."

The highlights summary draws from the three books now officially launched:

- Discoveries of the Census of Marine Life: Making Ocean Life Count(Cambridge University Press, 304 pages), by Paul V.R. Snelgrove, an overview of Census insights and their implications (http://coml.org/discoveries-census-marine-life);
- Life in the World's Oceans: Diversity, Distribution, and Abundance(Blackwell Publishing Ltd., 384 pages), Alasdair D. McIntyre (editor), a summary of findings and discoveries by the 17 Census projects (http://coml.org/life-worlds-oceans); and
- Citizens of the Sea: Wondrous Creatures from the Census of Marine Life,(National Geographic, 216 pages), by Nancy Knowlton, portraits of about 100 species (http://coml.org/citizens-sea).

Also released are:

- A National Geographic Society map, depicting the Census' work showing "Ocean Life: Diversity, Distribution, and Abundance" on one side and "Ocean Life: Past, Present and Future" on the other;
- New scientific reports from the Census of Marine Life added to the new open access Collections and Biodiversity Hub of the Public Library of Science (http://ploscollections.org/coml)
- And on Oct. 6: A song, "Look to the Sea,"contributed by singer/composer Maryann Camilleri, musician Jerry Harrison (formerly of the Talking Heads), and engineer David Dennison (responsible for numerous recordings of Jerry Garcia), with accompanying video by National Geographic Television / Digital Media (available for free download at 8 pm GMT Oct. 6). It joins a range of works of art including paintings, sculpture, films, and photography by many international artists inspired by the Census.
- The Census was initiated in 2000 through the efforts of Fred Grassle of Rutgers University, New Jersey, and Jesse Ausubel of the Alfred P. Sloan Foundation, New York. A 10-year deadline to accomplish their work was chosen. During its decade the Census grew to a $650 million global exploration, involving over 670 institutions and more than 10 times the original 250 collaborators. The Census reached its total of 17 projects in 2005.

The many partners of the Census included government agencies concerned with science, environment, and fisheries, navies, private philanthropic foundations, corporations, research institutions, universities, natural history museums, aquariums, and intergovernmental and international nongovernmental organizations and

programs. Many of the partners and sponsors are listed at www.comlsecretariat.org/about/partners-and-sponsors.

More than 300 leaders of the Census community meet 4-7 October in London at the Royal Institution of Great Britain, the Royal Society, and Natural History Museum to share their decade of results and consider their implications.

A sequel to the Census will be explored during the London meetings and at the World Conference on Marine Biodiversity next September in Aberdeen, Scotland.

Legacies of the first Census

Legacies of the first Census -- knowledge, technology, and habits of global co-operation -- will transmute its effort and expense into investment. These include:

- OBIS, sometimes called a "macroscope," a tool to reveal large patterns and grasp meaning in millions of marine life observations around the globe. OBIS is the world's largest marine species data archive, compiling centuries of observations to which Census scientists added their own in a freely accessible public infrastructure for research.
- Baselines of biodiversity, distribution, and abundance to assess damage from future oil spills and pollution or from climate change, such as warming water or a changing ocean chemistry.
- Findings recorded in books and reports, most freely accessible online.
- Sampling protocols and standards for information collection and archiving, imparting order and comparability around the globe and through time.
- Dependable information to improve national ocean policy and management, and the international Convention on Biological Diversity and other agreements to protect high seas resources, sustain fisheries, and regulate seabed mining.
- Means to identify the species of a specimen, even from a fish scale, using DNA barcoding.
- Marine elements of the incipient Global Earth Observation System of Systems, including:
- A growing global ocean tracking network of microphones to track salmon and other migrant animals, launched with an array from California past Canada to Alaska.
- A legion of "bio-logger" animals, thousands strong, equipped with compact devices that record data for future retrieval or for reporting in near real time on their diving and travels along the continents or across the oceans.
- Special sonar devices and techniques to see marine life assembling in schools and moving up, down, or across tens of thousands of square kilometers of ocean.
- Innovative "Autonomous Reef Monitoring Structures," which contribute to standardized global comparisons and monitoring of reef life.

Relevant Quotes

Jesse Ausubel of the USA, Census Co-founder and Alfred P. Sloan Foundation Program Director: "The Census encountered an ocean growing more crowded with commerce and transparent through technology. Setting out to draw baselines of the diversity, distribution, and abundance of species, the first Census of Marine Life documented a changing ocean, richer in diversity, more connected through distribution and movements, more impacted by humans, and yet less explored than we had known."

Fred Grassle of the USA, Census Co-Founder: "The Census has helped pour the foundation for the 'e-Biosphere,' a massive, comprehensive virtual observatory of world biodiversity now under construction.

OBIS and related rich initiatives like the Encyclopedia of Life, Barcode of Life initiative, and Google Earth pool environmental observations, specimen data, and experimental results into a global commons to enhance dramatically our ability to understand Earth's life."

Myriam Sibuet of France, Vice-Chair of the Scientific Steering Committee: "The Census enlarged the known world. Life astonished us everywhere we looked. In the deep sea we found luxuriant communities despite extreme conditions. The discoveries of new species and habitats both advanced science and inspired artists with their extraordinary beauty. Some newly discovered marine species have even entered popular culture, like the yeti crab painted on skateboards."

Victor Gallardo of Chile, Vice-Chair of the Scientific Steering Committee: "A human Census is used for many practical purposes, like government allocations of seats in a legislature, or funds for education and health care. Likewise this ocean life inventory constitutes a true Census that can guide conservation."

Patricia Miloslavich of Venezuela, Co-senior Scientist: "Before the Census, we lacked even a simple list of known marine species. Information was scattered all over the world with limited access. If we liken Earth to a firm with humankind as CEO, we must surely know the key employees and their functions."

Ron O'Dor of Canada, Co-senior Scientist: "The Census was a tour de force of technology. Many Census technologies can soon become part of a regular ocean observing system that provides timely reporting on the health of life in the oceans."

Paul Snelgrove of Canada, who led the assembly and report of Census results: "The Census united scientists from more than 80 nations with different talents, equipment, and interests. It matched the immensity and complexity of ocean life with a human enterprise able to grasp it. The understanding and well-being of marine life may well depend on continued unity of international science. "

Boris Worm of Canada, leader of the Census studies of the future: "Not only tuna and sea stars but also humans may be considered marine animals. The rapidly changing ocean that we are now uncovering helps us to understand ourselves. It compels us both to continue with journeys of discovery and to make wiser choices in the future."

Paul Joskow of the USA, President of the Alfred P. Sloan Foundation: "The achievements of the Census have inspired the Sloan Foundation to create a new set of fellowships to stimulate fundamental research by early-career ocean scientists of outstanding promise."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Census of Marine Life**, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/10/101004101319.htm

Alarming Increase in Flow of Water Into Oceans Due to Global Warming, Accelerated Cycle of Evaporation, Precipitation

River. Freshwater is flowing into Earth's oceans in greater amounts every year, a team of researchers has found, thanks to more frequent and extreme storms linked to global warming. All told, 18 percent more water fed into the world's oceans from rivers and melting polar ice sheets in 2006 than in 1994, with an average annual rise of 1.5 percent. (Credit: iStockphoto/Johnny Lye)

ScienceDaily (Oct. 4, 2010) — Freshwater is flowing into Earth's oceans in greater amounts every year, a team of researchers has found, thanks to more frequent and extreme storms linked to global warming. All told, 18 percent more water fed into the world's oceans from rivers and melting polar ice sheets in 2006 than in 1994, with an average annual rise of 1.5 percent.

"That might not sound like much -- 1.5 percent a year -- but after a few decades, it's huge," said Jay Famiglietti, UC Irvine Earth system science professor and principal investigator on the study, which will be published this week in *Proceedings of the National Academy of Sciences*. He noted that while freshwater is essential to humans and ecosystems, the rain is falling in all the wrong places, for all the wrong reasons.

"In general, more water is good," Famiglietti said. "But here's the problem: Not everybody is getting more rainfall, and those who are may not need it. What we're seeing is exactly what the Intergovernmental Panel on Climate Change predicted -- that precipitation is increasing in the tropics and the Arctic Circle with heavier, more punishing storms. Meanwhile, hundreds of millions of people live in semiarid regions, and those are drying up."

In essence, he said, the evaporation and precipitation cycle taught in grade school is accelerating dangerously because of greenhouse gas-fueled higher temperatures, triggering monsoons and hurricanes. Hotter weather

above the oceans causes freshwater to evaporate faster, which leads to thicker clouds unleashing more powerful storms over land. The rainfall then travels via rivers to the sea in ever-larger amounts, and the cycle begins again.

The pioneering study, which is ongoing, employs NASA and other world-scale satellite observations rather than computer models to track total water volume each month flowing from the continents into the oceans.

"Many scientists and models have suggested that if the water cycle is intensifying because of climate change, then we should be seeing increasing river flow. Unfortunately, there is no global discharge measurement network, so we have not been able to tell," wrote Famiglietti and lead author Tajdarul Syed of the Indian School of Mines, formerly of UCI.

"This paper uses satellite records of sea level rise, precipitation and evaporation to put together a unique 13-year record -- the longest and first of its kind. The trends were all the same: increased evaporation from the ocean that led to increased precipitation on land and more flow back into the ocean."

The researchers cautioned that although they had analyzed more than a decade of data, it was still a relatively short time frame. Natural ups and downs that appear in climate data make detecting long-term trends challenging. Further study is needed, they said, and is under way.

Other authors are Don Chambers of the University of South Florida, Joshua Willis of the Jet Propulsion Laboratory in Pasadena, and Kyle Hilburn of Remote Sensing Systems in Santa Rosa, Calif. Funding is provided by NASA.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California -- Irvine**.

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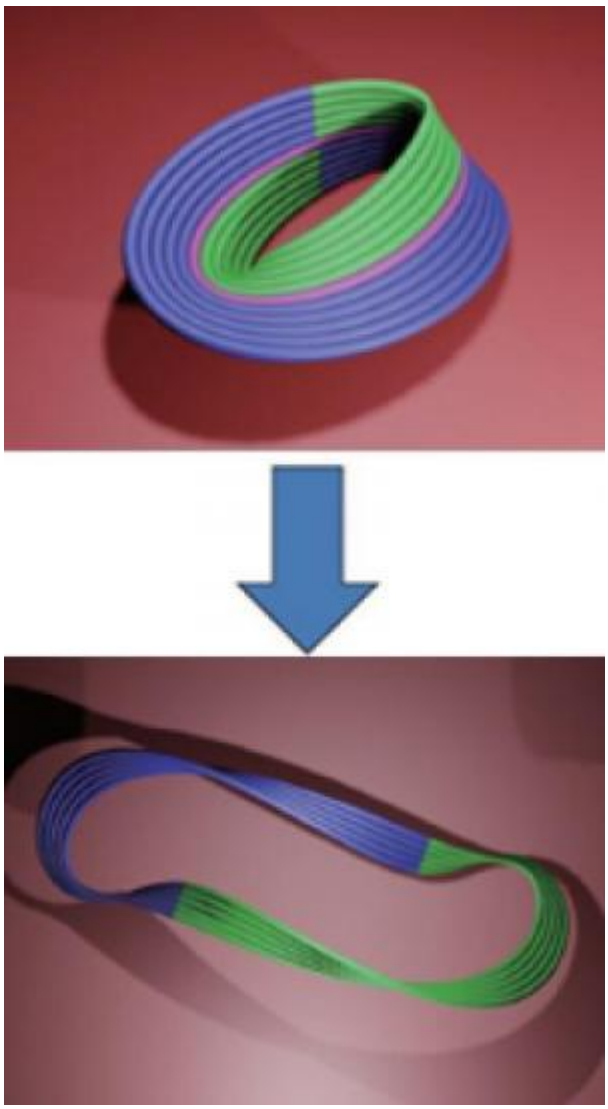
http://www.sciencedaily.com/releases/2010/10/101004151700.htm

DNA Art Imitates Life: Construction of a Nanoscale Mobius Strip

A Möbius strip cut along its centerline, yields a Kirigami-Ring. (Credit: Nature Nanotechnology)



ScienceDaily (Oct. 4, 2010) — The enigmatic Möbius strip has long been an object of fascination, appearing in numerous works of art, most famously a woodcut by the Dutchman M.C. Escher, in which a tribe of ants traverses the form's single, never-ending surface.

Scientists at the Biodesign Institute at Arizona State University's and Department of Chemistry and Biochemistry, led by Hao Yan and Yan Liu, have now reproduced the shape on a remarkably tiny scale, joining up braid-like segments of DNA to create Möbius structures measuring just 50 nanometers across -- roughly the width of a virus particle.

Eventually, researchers hope to capitalize on the unique material properties of such nano-architectures, applying them to the development of biological and chemical sensing devices, nanolithography, drug delivery mechanisms pared down to the molecular scale and a new breed of nanoelectronics.

The team used a versatile construction method known as DNA origami and in a dramatic extension of the technique, (which they refer to as DNA Kirigami), they cut the resulting Möbius shapes along their length to produce twisted ring structures and interlocking loops known as catenanes.

Their work appears in the October 4 advanced online issue of the journal *Nature Nanotechnology*. Graduate students involved in this work include Dongran Han and Suchetan Pal in the Yan group.

Making a Möbius strip in the everyday world is easy. Cut a narrow strip of paper, bring the two ends of the strip close to each other so that they match, but give them a half-twist before fastening the ends together with a piece of scotch tape. The resulting Möbius strip, which has only one surface and one boundary edge, is an example of a topological form.

"As nanoarchitects," Yan says, "we strive to create two classes of structure -- geometric and topological." Geometric structures in two and three dimensions abound in the natural world, from complex crystal shapes to

starfish, and unicellular organisms like diatoms. Yan cites such natural forms as a boundless source of inspiration for human-designed nanostructures.

Topology, a branch of mathematics, describes the spatial properties of shapes that may be twisted, stretched or otherwise deformed to yield new shapes. Such shape deformations may profoundly alter the geometry of an object, as when a donut shape is pinched and stretched into a figure eight, but the surface topology of such forms is unaffected.

Nature is also rich in topological structures, Yan notes, including the elegant Möbius. The circulations of earth's warmer and cooler ocean currents for example, describe a Möbius shape. Other topological structures are common to biological systems, particularly in the case of DNA, the 3 billion chemical bases of which are packed by the chromosome inside the cell, using topological structures. "In bacteria, plasmid DNA is wound into a supercoil," Yan explains. "Then the enzymes can come in and cut and reconfigure the topology to relieve the torsion in the supercoil so that all the other cellular machinery can have access to the gene for replication, transcription and so forth."

To form the Möbius strip in the current study, the group relied on properties of self-assembly inherent in DNA. A strand of DNA is formed from combinations of 4 nucleotide bases, adenine (A), thymine (T), cytosine (C) and guanine (G), which follow one another on the strand like necklace beads. These nucleotide beads can bind to each other according to a strict rule: A always pairs with T, C with G. Thus, a second, complementary strand of DNA binds with the first to form the DNA double helix.

In 2006, Paul Rothemund at Cal Tech demonstrated that the process of DNA self-assembly could be used to produce pre-designed 2D nanoarchitectures of astonishing variety. Thus, DNA origami emerged as a powerful tool for nanostructure design. The method relies on a long, single stranded segment of DNA, used as a structural scaffold and guided through base pairing to assume a desired shape. Short, chemically synthesized "staple strands," composed of complementary bases are used to hold the structure in place.

After synthesis and mixing of DNA staples and scaffold strands, the structure is able to self-assemble in a single step. The technique has been used to produce remarkable nanostructures of smiley faces, squares, disks, geographic maps, and even words, at a scale of 100 nm or less. But the creation of topological forms capable of reconfiguration, like those produced by nature, has proven more challenging.

Once the tiny Möbius structures had been created, they were examined with atomic force- and transmission electron microscopy. The startling images confirm that the DNA origami process efficiently produced Escher-like Möbius strips measuring less than a thousandth the width of a human hair. Yan notes that the Möbius forms displayed both right and left handed twists. Imaging permitted the handedness or chirality of each flattened nanostructure to be determined, based on the height differences observed at the overlapping areas.

Next, the team demonstrated the topological flexibility of the Möbius forms produced, using a folding and cutting -- or DNA Kirigami -- technique. The Möbius can be modified by cutting along the length of the strip at different locations. Cutting a Möbius along its centerline yields a new structure -- a looped form containing a twist of 720 degrees or 4 half-twists. The design, which the group calls a Kirigami-Ring is no longer a Möbius as it has two edges and two surfaces. The Möbius may also be cut along its length one-third of the way into its width, producing a Kirigami-Catenane -- a Möbius strip interlinked with a supercoiled ring.

To accurately cut the Möbius nanostructures, a technique known as strand displacement was used, in which the DNA staples holding the central helix in place are outfitted with so-called toe-hold strands which protrude

from the central helix. A complementary strand binds to the toehold segment, removing the staples and allowing the Möbius to fall open into either the Kirigami-Ring or Kirigami-Catenane.

Again, the successful synthesis of these forms was confirmed through microscopy, with the Kirigami-Ring structures gradually relaxing into figure eights.

Yan stresses that the success of the new study relied heavily on lead author Dongran Han's remarkable sense of three-dimensional space, allowing him to design geometrical and topological structures in his head. "Han and also Pal are particularly brilliant students," Yan says, pointing out that the complex conceptualization of the nanoarchitectures in their research is primarily performed without computer aid. The group hopes in the future to create software capable of simplifying the process.

"We want to push the Origami-Kirigami technology to create more sophisticated structures to demonstrate that we can make any arbitrary shape or topology using self-assembly," Han says.

Having made inroads into sculpture, painting and even literature, (particularly, the novels of French author Alain Robbe-Grillet), topological structures are now poised to influence scientific developments at the tiniest scale.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Arizona State University**, via EurekAlert!, a service of AAAS. The original article was written by Richard Harth.

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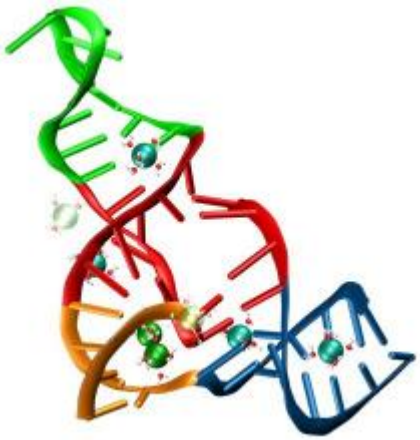
http://www.sciencedaily.com/releases/2010/10/101004101530.htm

Powerful Supercomputer Peers Into the Origin of Life



New research at Oak Ridge National Laboratory explains how a ribonucleic acid enzyme, or ribozyme (pictured), uses magnesium ions (seen as spheres) to accelerate a significant reaction in organic chemistry. (Credit: Image courtesy of DOE/Oak Ridge National Laboratory)

ScienceDaily (Oct. 4, 2010) — Supercomputer simulations at the Department of Energy's Oak Ridge National Laboratory are helping scientists unravel how nucleic acids could have contributed to the origins of life.

A research team led by Jeremy Smith, who directs ORNL's Center for Molecular Biophysics and holds a Governor's Chair at University of Tennessee, used molecular dynamics simulation to probe an organic chemical reaction that may have been important in the evolution of ribonucleic acids, or RNA, into early life forms.

Certain types of RNA called ribozymes are capable of both storing genetic information and catalyzing chemical reactions -- two necessary features in the formation of life. The research team looked at a lab-grown ribozyme that catalyzes the Diels-Alder reaction, which has broad applications in organic chemistry.

"Life means making molecules that reproduce themselves, and it requires molecules and are sufficiently complex to do so," Smith said. "If a ribozyme like the Diels-Alderase is capable of doing organic chemistry to build up complex molecules, then potentially something like that could have been present to create the building blocks of life."

The research team found a theoretical explanation for why the Diels-Alder ribozyme needs magnesium to function. Computational models of the ribozyme's internal motions allowed the researchers to capture and understand the finer details of the fast-paced reaction. The static nature of conventional experimental techniques such as chemical probing and X-ray analysis had not been able to reveal the dynamics of the system.

"Computer simulations can provide insight into biological systems that you can't get any other way," Smith said. "Since these structures are changing so much, the dynamic aspects are difficult to understand, but simulation is a good way of doing it."

Smith explained how their calculations showed that the ribozyme's internal dynamics included an active site, or "mouth," which opens and closes to control the reaction. The concentration of magnesium ions directly impacts the ribozyme's movements.

"When there's no magnesium present, the mouth closes, the substrate can't get in, and the reaction can't take place. We found that magnesium ions bind to a special location on the ribozyme to keep the mouth open," Smith said.

The research was published as "Magnesium-Dependent Active-Site Conformational Selection in the Diels-Alderase Ribozyme" in the Journal of the American Chemical Society. The research team included Tomasz Berezniak and Mai Zahran, who are Smith's graduate students, and Petra Imhof and Andres Jäschke from the University of Heidelberg.

Smith's research was supported by Laboratory Directed Research and Development program funding. The bulk of the simulations were performed on the Kraken supercomputer at the UT/ORNL National Institute for Computational Sciences, supported by a National Science Foundation Teragrid allocation, and the resulting data were analyzed on the Heidelberg Linux Cluster System at the Interdisciplinary Center for Scientific Computing of the University of Heidelberg.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **DOE/Oak Ridge National Laboratory**.

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http://www.sciencedaily.com/releases/2010/10/101004151725.htm

Physicists Control Chemical Reactions Mechanically

Giovanni Zocchi, UCLA professor of physics (right), and UCLA graduate student Hao Qu. (Credit: Reed Hutchinson/UCLA)

ScienceDaily (Oct. 4, 2010) — UCLA physicists have taken a significant step in controlling chemical reactions mechanically, an important advance in nanotechnology, UCLA physics professor Giovanni Zocchi and colleagues report.

Chemical reactions in the cell are catalyzed by enzymes, which are protein molecules that speed up reactions. Each protein catalyzes a specific reaction. In a chemical reaction, two molecules collide and exchange atoms; the enzyme is the third party, the "midwife to the reaction."

But the molecules have to collide in a certain way for the reaction to occur. The enzyme binds to the molecules and lines them up, forcing them to collide in the "right" way, so the probability that the molecules will exchange atoms is much higher.

"Instead of just watching what the molecules do, we can mechanically prod them," said Zocchi, the senior author of the research.

To do that, Zocchi and his graduate students, Chiao-Yu Tseng and Andrew Wang, attached a controllable molecular spring made of DNA to the enzyme. The spring is about 10,000 times smaller than the diameter of a human hair. They can mechanically turn the enzyme on and off and control how fast the chemical reaction occurs. In their newest research, they attached the molecular spring at three different locations on the enzyme and were able to mechanically influence different specific steps of the reaction.

They published their research in the journal *Europhysics Letters*, a publication of the European Physical Society, in July.

"We have stressed the enzyme in different ways," Zocchi said. "We can measure the effect on the chemical reaction of stressing the molecule this way or that way. Stressing the molecule in different locations produces different responses. If you attach the molecular spring in one place, nothing much happens to the chemical reaction, but you attach it to a different place and you affect one step in the chemical reaction. Then you attach it to a third place and affect another step in this chemical reaction."

Zocchi, Tseng and Wang studied the rate of the chemical reactions and reported in detail what happened to the steps of the reactions as they applied mechanical stress to the enzyme at different places.

"Standing on the shoulders of 50 years of structural studies of proteins, we looked beyond the structural description at the dynamics, specifically the question of what forces -- and applied where -- have what effect on the reaction rates," Zocchi said.

In a related second paper, Zocchi and his colleagues reached a surprising conclusion in solving a longstanding physics puzzle.

When one bends a straight tree branch or a straight rod by compressing it longitudinally, the branch or rod at first remains straight and does not bend until a certain critical force is exceeded. At the critical force, it does not bend a little -- it suddenly buckles and bends a lot.

"This phenomenon is well known to any child who has made bows from hazelnut bush branches, for example, which are typically quite straight. To string the bow, you have to press down on it hard to buckle it, but once it is bent, you need only a smaller force to keep it so," Zocchi said.

The UCLA physicists studied the elastic energy of their DNA molecular spring when it is sharply bent.

"Such a short double-stranded DNA molecule is somewhat similar to a rod, but the elasticity of DNA at this scale was not known," Zocchi said. "What is the force the DNA molecular spring is exerting on the enzyme? We have answered this question.

"We find there is a similar bifurcation with this DNA molecule. It goes from being bent smoothly to having a kink. When we bend this molecule, there is a critical force where there is a qualitative difference. The molecule is like the tree branch and the rod in this respect. If you're just a little below the threshold, the system has one kind of behavior; if you're just a little above the threshold force, the behavior is totally different. The achievement was to measure directly the elastic energy of this stressed molecule, and from the elastic energy characterize the kink."

Co-authors on this research are UCLA physics graduate students Hao Qu, Chiao-Yu Tseng and Yong Wang and UCLA associate professor of chemistry and biochemistry Alexander Levine, who is a member of the California NanoSystems Institute at UCLA. The research was published in April, also in the journal *Europhysics Letters*.

"We can now measure for any specific DNA molecule what the elastic energy threshold for the instability is," Zocchi said. "I see beauty in this important phenomenon. How is it possible that the same principle applies to a tree branch and to a molecule? Yet it does. The essence of physics is finding common behavior in systems that seem very different."

While Zocchi's research may have applications for medicine and other fields, he emphasizes the advance in knowledge itself.

"There is value in science that adds to our knowledge and helps us understand our world, apart from the value of future applications," he said. "I study problems that I find interesting, where I think I can make a contribution. Why study a particular problem rather than another? Perhaps for the same reason a painter chooses a particular landscape. Perhaps we see beauty there."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California -- Los Angeles**. The original article was written by Stuart Wolpert.

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Novelty and Complexity Are Result of Small Evolutionary Changes

The atomic structure of nuclear receptor proteins reflects tinkering with an ancestral template. This cartoon rendering shows the superimposed atomic structures of five distantly related nuclear receptors that are activated by different chemical signals. The colored cylinders show the position of stable corkscrew-like helices in the receptor's atomic structure; the white strands show flexible loops. The chemical signals -- including hormones, fatty acids, retinoids and other molecules -- are shown as gray spheres. The ability of the proteins to be activated by different signals is due to subtle changes in the size and surface properties of the "pocket" where the signal binds, not a fundamental redesign of the receptor structure. (Credit: Courtesy of Joseph Thornton)

ScienceDaily (Oct. 5, 2010) — By reconstructing an ancient protein and tracing how it subtly changed over vast periods of time to produce scores of modern-day descendants, scientists have shown how evolution tinkers with early forms and leaves the impression that complexity evolved many times.

Human and other animal cells contain thousands of proteins with functions so diverse and complex that it is often difficult to see how they could have evolved from a few ancestral proteins, said biologist Joseph W. Thornton of the University of Oregon and the Howard Hughes Medical Institute, who led the research.

The team's findings are detailed in the October issue of the online open-access journal *PLoS Biology*.

Thornton's team, which included researchers from the University of Queensland (Australia) and Emory University in Atlanta, Ga., studied a large family of related proteins called nuclear receptors. These receptors regulate development, reproduction, metabolism and cancer by triggering the expression of specific genes in response to hormones, nutrients and other chemical signals.

A handful of nuclear receptors, however, do not have to be activated by a chemical signal: they are stable enough to trigger gene expression on their own. Scientists have long thought that the ancestral protein was of

this simpler type, implying that the complex capacity to bind and be regulated by chemical signals evolved independently in many lineages.

Using a database of the molecular sequences, functions, and atomic structures of hundreds of modern-day receptor proteins, the researchers reconstructed the biochemical characteristics of the ancestral nuclear receptor, which existed before the last common ancestor of all animals on earth -- as much as a billion years ago.

They found that the ancestral receptor in fact required activation by a chemical signal -- most likely a fatty acid, a class of substances commonly found in animal diets. They also found that the underlying atomic mechanisms that allowed the ancestral protein to be activated by chemical signals were conserved in virtually all present-day descendants.

The researchers then traced how evolution tinkered with the ancestral structure over time. They found that in various lineages, receptors evolved partnerships with new hormones or other signals, because a few mutations subtly changed the size and shape of the cavity where the signaling compound binds. Other members of the receptor family became independent of chemical signals; these proteins, like switches stuck in the "on" position, evolved when simple mutations increased the proteins' intrinsic stability, removing the need for it to interact with a chemical signal to activate gene expression.

"If you just compare the receptors in modern humans, the evolutionary events by which they could have evolved are not obvious. It may look as if the complex functions of each protein evolved independently," said Thornton, an HHMI early career scientist and professor in the UO's Center for Ecology and Evolutionary Biology. "But when we traced these proteins from their ancestor through time, we saw how evolution tinkered with the ancestral form, producing an incredible diversity of protein functions and the ability to interact with many different chemical signals.

Thornton's group was able to accurately reconstruct the ancestral receptor protein by gathering extensive new data about its descendants in species that diverged very early from other animals. They first scanned the genomes of sponges, sea anemones and a host of other animal species to collect the sequences of their nuclear receptors. Sponges, they found, had just two such proteins, while humans have 48. By reconstructing the evolutionary tree of the entire receptor family, they found that the two sponge proteins branched off closest to the root, providing insights into the likely state of the ancestor.

The scientists then extracted the receptors from *Amphimedon queenslandica*, a sponge from the Great Barrier Reef, and showed that these receptors, like some of the other early-evolving receptors, bind fatty acids. They used computational methods to predict the three-dimensional atomic structure of the sponge proteins to show that they bound the fatty acid in a cavity very similar to that in some receptors in mammals.

"Nuclear receptors are a great case-study in protein evolution," he said. "It's likely that other protein families, when studied in similar detail, will turn out to have diversified by a similar kind of tinkering. What looks like novelty turns out to have evolved by making subtle changes to something very old."

Co-authors on the paper with Thornton were: Jamie T. Bridgham, also an HHMI researcher and member of the Center for Ecology and Evolutionary Biology (CEEB) at the UO; Geeta N. Eick and Michael J. Harms, both of the UO's CEEB; Claire Larroux, Marie E.A. Gauthier and Bernard M. Degnan, all of the University of Queensland, in Brisbane, Australia; and Eric A. Ortlund of the Emory School of Medicine.

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Story Source:

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

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http://www.sciencedaily.com/releases/2010/10/101005171032.htm

Mice With Human Body's Defenses

ScienceDaily (Oct. 5, 2010) — Therapeutic antibodies can be an efficient alternative when common drugs do not work anymore. However, antibodies obtained from blood of animals such as mice could not be used: The human immune system recognizes them as foreign and rejects them. In an international cooperation, scientists from the Helmholtz Centre for Infection Research (HZI) in Braunschweig, Germany have now succeeded in developing a promising approach to solve this problem; with the help of human stem cells they generated mice with a human immune system, which were then vaccinated to produce human monoclonal antibodies.

These fully human antibodies could help in the research and therapy of human diseases. Their results have now been published in the current online issue of the scientific journal *PLoS One*.

Antibodies are small proteins, produced by B cells during an immune response. They bind at and thus mark invading pathogens so that scavenger cells recognize and destroy them. "The task of our immune system is to distinguish between self and non-self structures," says Professor Carlos A. Guzmàn, head of the department of "Vaccinology and Applied Microbiology" at the HZI. "This means also that only human antibodies come into question for an antibody therapy," since the human immune system fights antibodies from mice -- a threat for the patient. Furthermore, it is cumbersome to humanize murine antibodies for human treatment or to generate human B cell clones producing high quantities of antibodies.The scientists used an already established method to give a human immune system to mice, which were then exploited to solve this problem: they injected human stem cells into young mice that due to a genetic defect lack an immune system. The stem cells migrate into the bone marrow, proliferate, differentiate and lead to the generation of a human immune system. "In our in-depth investigations we were able to detect all important types of immune cells in these mice," says Dr. Pablo Becker, scientist in the HZI department "Vaccinology and Applied Microbiology."To validate the new approach, mice with a human immune system were vaccinated against Hepatitis B or Tetanus. The scientists then isolated human antibody producing B cells from the mice and treated them so that they survive outside the body in a cell culture dish and continue producing antibodies. Then, the researchers took a deeper look at the antibodies. The results give hope: "Antibodies from mice with a human immune system showed good properties in our tests, but the model still needs to be improved for broad implementation in biomedicine," says Pablo Becker. "However, we were able to demonstrate for the first time that it is possible to produce human monoclonal antibodies using humanized mice." Now it is important to improve this mouse model to use it one day for the development of advanced therapies against human diseases. "In the future this approach might represent the most powerful tool to develop therapeutic antibodies for clinical use," hopes Becker.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Helmholtz Association of German Research Centres**, via EurekAlert!, a service of AAAS.

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Wind Farms Extend Growing Season in Certain Regions

Many wind farms, especially in the Midwestern United States, are located on farmland. According to Roy, the nocturnal warming effect could offer farmland some measure of frost protection and may even slightly extend the growing season. (Credit: iStockphoto/Stephen Goodwin)

ScienceDaily (Oct. 5, 2010) — Wind power is likely to play a large role in the future of sustainable, clean energy, but wide-scale adoption has remained elusive. Now, researchers have found wind farms' effects on local temperatures and proposed strategies for mediating those effects, increasing the potential to expand wind farms to a utility-scale energy resource.

Led by University of Illinois professor of atmospheric sciences Somnath Baidya Roy, the research team will publish its findings in the *Proceedings of the National Academy of Sciences*. The paper will appear in the journal's Online Early Edition this week.

Roy first proposed a model describing the local climate impact of wind farms in a 2004 paper. But that and similar subsequent studies have been based solely on models because of a lack of available data. In fact, no field data on temperature were publicly available for researchers to use, until Roy met Neil Kelley at a 2009 conference. Kelley, a principal scientist at the National Wind Technology Center, part of the National Renewable Energy Laboratory, had collected temperature data at a wind farm in San Gorgonio, Calif., for more than seven weeks in 1989.

Analysis of Kelley's data corroborated Roy's modeling studies and provided the first observation-based evidence of wind farms' effects on local temperature. The study found that the area immediately surrounding turbines was slightly cooler during the day and slightly warmer at night than the rest of the region.

As a small-scale modeling expert, Roy was most interested in determining the processes that drive the daytime cooling and nocturnal warming effects. He identified an enhanced vertical mixing of warm and cool air in the atmosphere in the wake of the turbine rotors. As the rotors turn, they generate turbulence, like the wake of a speedboat motor. Upper-level air is pulled down toward the surface while surface-level air is pushed up, causing warmer and cooler air to mix.

The question for any given wind-farm site then becomes, will warming or cooling be the predominant effect?

"It depends on the location," Roy said. "For example, in the Great Plains region, the winds are typically stronger at night, so the nocturnal effect may dominate. In a region where daytime winds are stronger -- for example a sea breeze -- then the cooling effect will dominate. It's a very location-specific thing."

Many wind farms, especially in the Midwestern United States, are located on farmland. According to Roy, the nocturnal warming effect could offer farmland some measure of frost protection and may even slightly extend the growing season.Understanding the temperature effects and the processes that cause them also allows researchers to develop strategies to mitigate wind farms' impact on local climate. The group identified two possible solutions. First, engineers could develop low-turbulence rotors. Less turbulence would not only lead to less vertical mixing and therefore less climate impact, but also would be more efficient for energy generation. However, research and development for such a device could be a costly, labor-intensive process.

The second mediation strategy is locational. Turbulence from the rotors has much less consequence in an already turbulent atmosphere. The researchers used global data to identify regions where temperature effects of large wind farms are likely to be low because of natural mixing in the atmosphere, providing ideal sites.

"These regions include the Midwest and the Great Plains as well as large parts of Europe and China," Roy said. "This was a very coarse-scale study, but it would be easy to do a local-scale study to compare possible locations."Next, Roy's group will generate models looking at both temperature and moisture transport using data from and simulations of commercial rotors and turbines. They also plan to study the extent of the thermodynamic effects, both in terms of local magnitude and of how far downwind the effects spread.

"The time is right for this kind of research so that, before we take a leap, we make sure it can be done right," Roy said. "We want to identify the best way to sustain an explosive growth in wind energy over the long term. Wind energy is likely to be a part of the solution to the atmospheric carbon dioxide and the global warming problem. By indentifying impacts and potential mitigation strategies, this study will contribute to the long-term sustainability of wind power."

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

1. S. Baidya Roy, J. J. Traiteur. **Impacts of wind farms on surface air temperatures**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1000493107

http://www.sciencedaily.com/releases/2010/10/101005121726.htm

MicroRNA That May Allow for Better Control Cholesterol Levels in Blood Identified

Angel Baldan, Ph.D. (Credit: Image courtesy of Saint Louis University)

ScienceDaily (Oct. 5, 2010) — Thanks to a discovery by a Saint Louis University researcher, scientists have identified an important microRNA that may allow us to better control cholesterol levels in blood.

Led by Ángel Baldán, Ph.D., assistant professor of biochemistry and molecular biology at Saint Louis University and published in a recent issue of *Proceedings of the National Academy of Sciences*, the study found that the microRNA miR-33, may be key to controlling HDL, or "good" cholesterol levels.

In the U.S., heart attack, stroke, and peripheral artery disease collectively account for more than 30 percent of all deaths in the last decade. Atherosclerosis, the fatty build-up in arteries that causes these illnesses, is tied to cholesterol levels, a waxy substance found in the blood.

Statins, drugs frequently prescribed by doctors to manage cholesterol levels, work by lowering LDL, or "bad" cholesterol levels; however, their role in HDL cholesterol is still obscure. Importantly, HDL has been found to have a protective benefit against cardiovascular disease.

"Atherosclerosis costs lives and takes an enormous toll on our health," said Baldán. "If the discovery that miR-33 can be used to raise HDL levels leads to better medications, it will have an enormous impact on our ability to treat heart disease."

The study, which was funded by the National Institutes of Health, Saint Louis University Center for Cardiovascular Research and the Doisy Department of Biochemistry and Molecular Biology at Saint Louis University, examined SREBP-2, an important gene in the body, and zeroed in on the microRNA miR-33, which is expressed within SREBP-2.

Increasing the levels of miR-33 in the liver, scientists discovered, resulted in lower HDL cholesterol levels in an animal model; conversely, turning off miR-33, researchers found, had the effect of raising HDL levels.

Paralleling these results, four separate studies reported similar findings, adding to investigators' hope that better medications may be on the horizon for managing atherosclerosis. Scientists hope that future medications may prove to be more effective than statins alone by not only lowering LDL-cholesterol levels, but also increasing HDL levels.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Saint Louis University**.

Journal Reference:

1. T. J. Marquart, R. M. Allen, D. S. Ory, A. Baldan. **miR-33 links SREBP-2 induction to repression of sterol transporters**. *Proceedings of the National Academy of Sciences*, 2010; 107 (27): 12228 DOI: 10.1073/pnas.1005191107

http://www.sciencedaily.com/releases/2010/10/101005131956.htm

Thirst for Excitement Is Hidden in Your Genes

Researchers have found that a group of mutations that help predict whether someone is inclined toward sensation seeking. (Credit: iStockphoto/Slavenko Vukasovic)

ScienceDaily (Oct. 5, 2010) — Sensation seeking -- the urge to do exciting things -- has been linked to dopamine, a chemical that carries messages in your brain. For a new study published in *Psychological Science,* a journal of the Association for Psychological Science, scientists analyzed genes in the dopamine system and found a group of mutations that help predict whether someone is inclined toward sensation seeking.

Sensation seeking has been linked to a range of behavior disorders, such as drug addiction. It isn't all bad, though.

"Not everyone who's high on sensation seeking becomes a drug addict. They may become an Army Ranger or an artist. It's all in how you channel it," says Jaime Derringer, a PhD student at the University of Minnesota and the first author of the study. She wanted to use a new technique to find out more about the genetics of sensation seeking. Most obvious connections with genes, like the BRCA gene that increases the risk for breast cancer, have already been found, Derringer says. Now new methods are letting scientists look for more subtle associations between genes and all kinds of traits, including behavior and personality.

Derringer used a kind of mutation in DNA called a single-nucleotide polymorphism, or SNP. A SNP is a change in just one "letter" of the DNA. She started by picking eight genes with various roles related to the neurotransmitter dopamine, which has been linked to sensation seeking in other studies. She looked at group of 635 people who were part of a study on addiction. For each one, she had genetic information on 273 SNPs known to appear in those 8 genes and a score for how much they were inclined to sensation seeking. Using that data, she was able to narrow down the 273 SNPs to 12 potentially important ones. When she combined these 12 SNPs, they explained just under 4 percent of the difference between people in sensation seeking. This may not seem like a lot, but it's "quite large for a genetic study," Derringer says.

It's too soon to go out and start screening people for these mutations; not enough is known about how genes affect behavior. "One of the things we think is most exciting about this isn't necessarily the story about dopamine and sensation seeking," says Derringer. "It's rather the method that we're using. We used a sample of 635 people, which is extremely small, and we were still able to detect a significant effect. That's actually quite rare in these studies." She said the same method could be used to look at the link between biology and other behaviors -- dopamine and cocaine dependence, for example, or serotonin and depression.

Eventually these methods could lead to tests that might help predict whether someone is likely to have problems later, and whether there should be early intervention to guide them down a healthier path.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Association for Psychological Science**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Jaime Derringer, Robert F. Krueger, Danielle M. Dick, Scott Saccone, Richard A. Grucza, Arpana Agrawal, Peng Lin, Laura Almasy, Howard J. Edenberg, Tatiana Foroud, John I. Nurnberger, Jr., Victor M. Hesselbrock, John R. Kramer, Samuel Kuperman, Bernice Porjesz, Marc A. Schuckit, Laura J. Bierut, Gene Environment Association Studies (GENEVA) Consortium. **Predicting Sensation Seeking From Dopamine Genes: A Candidate-System Approach**. *Psychological Science*, 2010; 21 (9): 1282-1290 DOI: 10.1177/0956797610380699

http://www.sciencedaily.com/releases/2010/10/101005171036.htm

MAVEN Mission to Investigate How Sun Steals Martian Atmosphere

An artist's conception of the MAVEN spacecraft orbiting Mars. (Credit: NASA/Goddard Space Flight Center)

ScienceDaily (Oct. 5, 2010) — NASA's mission to investigate the mystery of how Mars lost much of its atmosphere passed a critical milestone on October 4, 2010. NASA has given approval for the development and 2013 launch of the Mars Atmosphere and Volatile Evolution (MAVEN) mission.

Clues on the Martian surface, such as features resembling dry riverbeds and minerals that only form in the presence of liquid water, suggest that Mars once had a denser atmosphere, which supported the presence of liquid water on the surface. As part of a dramatic climate change, most of the Martian atmosphere was lost. MAVEN will make definitive scientific measurements of present-day atmospheric loss that will offer insight into the Red Planet's history.

Michael Luther, on behalf of Dr. Ed Weiler, of the NASA Headquarters Science Mission Directorate led a confirmation review panel that approved the detailed plans, instrument suite, budget, and risk factor analysis for the spacecraft.

"A better understanding of the upper atmosphere and the role that escape to space has played is required to plug a major hole in our understanding of Mars. We're really excited about having the opportunity to address these fundamental science questions," said MAVEN Principal Investigator Dr. Bruce Jakosky of the Laboratory for Atmospheric and Space Physics at the University of Colorado (CU-LASP) at Boulder.

"The team has successfully met every major milestone since selection two years ago," said MAVEN Project Manager David Mitchell of NASA's Goddard Space Flight Center, Greenbelt, Md. "Looking forward, we are well positioned for the next push to critical design review in July 2011. In three short years, we'll be heading to Mars!"

The confirmation review, formally known as "Key Decision Point C," authorized continuation of the project into the development phase and set its cost and schedule. The next major mission milestone, the critical

design review, will examine the detailed MAVEN system design. After a successful critical design review, the project team will assemble the spacecraft and its instruments.

"This project is a vital complement to past, present, and future Mars missions," said Dr. Michael Meyer, lead Mars Scientist for NASA's Mars Exploration Program in Washington. "MAVEN will take us a step closer in learning about the evolution of our intriguing celestial neighbor."

NASA Goddard will manage the project, which will cost $438 million excluding the separately government-furnished launch vehicle and telecommunications relay package. Goddard will also build some of the instruments for the mission. In addition to the PI coming from CU-LASP, the university will provide science operations, build instruments, and lead Education/Public Outreach. Lockheed Martin of Littleton, Colo., will build the spacecraft based on designs from NASA's Mars Reconnaissance Orbiter and 2001 Mars Odyssey missions and perform mission operations. The University of California-Berkeley Space Sciences Laboratory will also build instruments for the mission. NASA's Jet Propulsion Laboratory, Pasadena, Calif., will provide navigation support, the Deep Space Network, and the Electra telecommunications relay hardware and operations.

For more about MAVEN, see: www.nasa.gov/maven

For the related feature story, see: www.nasa.gov/mission_pages/maven/news/confirmation.html

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Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **NASA/Goddard Space Flight Center**.

http://www.sciencedaily.com/releases/2010/10/101005170515.htm

Low Testosterone Linked to Alzheimer's Disease

ScienceDaily (Oct. 5, 2010) — Low levels of the male sex hormone, testosterone, in older men is associated with the onset of Alzheimer's disease, according to research by a team that includes a Saint Louis University scientist.

"Having low testosterone may make you more vulnerable to Alzheimer's disease," said John E. Morley, M.D., director of the division of geriatric medicine at Saint Louis University and a study co-investigator. "The take-home message is we should pay more attention to low testosterone, particularly in people who have memory problems or other signs of cognitive impairment."

The study was published electronically prior to its print publication scheduled in the September issue of the *Journal of Alzheimer's Disease* and led by Leung-Wing Chu, M.D., who is chief of the division of geriatric medicine at Queen Mary Hospital at the University of Hong Kong.

Researchers studied 153 Chinese men who were recruited from social centers. They were at least 55 years and older, lived in the community and didn't have dementia. Of those men, 47 had mild cognitive impairment -- or problems with clear thinking and memory loss.

Within a year, 10 men who all were part of the cognitively impaired group developed probable Alzheimer's disease. These men also had low testosterone in their body tissues; elevated levels of the ApoE 4 (apolipoprotein E) protein, which is correlated with a higher risk of Alzheimer's disease; and high blood pressure.

"It's a very exciting study because we've shown that a low level of testosterone is one of the risk factors for Alzheimer's disease," Morley said.

The findings corroborate findings in previous studies of older Caucasian men that show low testosterone is associated with impaired thinking and Alzheimer's disease. They suggest that testosterone may have a protective value against Alzheimer's disease.

The next step, Morley said, is to conduct a large-scale study that investigates the use of testosterone in preventing Alzheimer's disease. Morley and his co-authors advocate studying the effectiveness of testosterone replacement in older men who have both mild memory problems and low testosterone in staving off Alzheimer's disease.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Saint Louis University**.

Journal Reference:

1. Leung-Wing Chu, Sidney Tam, Rachel LC Wong, Ping-Yiu Yik, Youqiang Song, Bernard MY Cheung, John E Morley, Karen SL Lam. **Bioavailable Testosterone Predicts a Lower Risk of Alzheimer's Disease in Older Men**. *Journal of Alzheimer's Disease*, 2010; 21 (4) [link]

http://www.sciencedaily.com/releases/2010/10/101005171202.htm

Researchers Pool Data to Search for Genetic Risks in Heart Disease

ScienceDaily (Oct. 5, 2010) — In an unprecedented international project, researchers have found multiple genetic mutations that play a role in heart attack or coronary artery disease (CAD) risk.

The Coronary ARtery DIsease Genome-wide Replication And Meta-Analysis (CARDIoGRAM) -- published in *Circulation: Cardiovascular Genetics*, an American Heart Association journal -- consists of data from every published whole-genome study on genetic mutations in heart attack or CAD risk. Researchers are also pooling data from several unpublished genome-wide association studies to see if any new mutations can be uncovered.

The consortium will analyze the complete genetic profiles of more than 22,000 people of European descent with CAD or a heart attack history, and 60,000 healthy people -- 10 times more than in the next largest whole-genome study to date.

Investigators have examined an average 2.2 million single nucleotide polymorphisms (SNPs) in each of the whole-genome studies included in the review. SNPs, or "snips," are genetic variants at specific locations on individual chromosomes. Sometimes these variants manifest themselves as a disease or susceptibility to a disease. Modern technology allows hundreds of thousands of SNPs to be scanned in a person.

"Only a small proportion of the inheritability of CAD has been explained," said Heribert Schunkert, M.D., a professor of medicine at the University of Lübeck in Germany and a spokesman for CARDIoGRAM. "We have to accept that almost all persons of European ancestry carry multiple small genetic defects that mediate some coronary artery disease risk. The main aim of the consortium is to identify new disease mechanisms to improve risk prevention."

The task is challenging because of the complex nature of atherosclerosis, with multiple genetic factors contributing in small ways to the disease, he said.

Genome-wide association studies provide an unprecedented sensitivity to detect genetic variants affecting disease risk, and researchers rely on the studies' sample size. However, in a typical genome-wide association study with about 1,000 patients and controls, the power to detect a SNP with a significant effect is low.

"Collectively, our consortium increases the power of these findings 10-fold," Schunkert said. "By pooling all of the published and unpublished data, we hope to make discoveries that might have been overlooked. Given that up to 2.5 million comparisons are carried out, in parallel, for each whole-genome scan, distinguishing between true and false associations has been difficult."

The data will be maintained in a central database, and each SNP that appears related to heart disease will be subjected to replication studies to confirm its significance. Numerous SNPs and the proteins they express increase risk of CAD or heart attack. But it's unknown whether they're acting alone or with other genetic variables, Schunkert said.

"We hope that by combining all of the known whole-genome data, we will be able to provide some answers," he said.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Heart Association**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Michael Preuss, Inke R. König, John R. Thompson, Jeanette Erdmann, Devin Absher, Themistocles L. Assimes, Stefan Blankenberg, Eric Boerwinkle, Li Chen, L. Adrienne Cupples, Alistair S. Hall, Eran Halperin, Christian Hengstenberg, Hilma Holm, Reijo Laaksonen, Mingyao Li, Winfried März, Ruth McPherson, Kiran Musunuru, Christopher P. Nelson, Mary Susan Burnett, Stephen E. Epstein, Christopher J. O'Donnell, Thomas Quertermous, Daniel J. Rader, Robert Roberts, Arne Schillert, Kari Stefansson, Alexandre F.R. Stewart, Gudmar Thorleifsson, Unnur Thorsteinsdottir, Benjamin F. Voight, George A. Wells, Andreas Ziegler, Sekar Kathiresan, Muredach P. Reilly, Nilesh J. Samani, and Heribert Schunkert. **Design of the Coronary Artery Disease Genome-Wide Replication and Meta-Analysis (CARDIoGRAM) Study — A Genome-Wide Association Meta-Analysis Involving More than 22,000 Cases and 60,000 Controls**. *Circ Cardiovasc Genet*, October 5, 2010 DOI: 10.1161/CIRCGENETICS.109.899443

http://www.sciencedaily.com/releases/2010/10/101005161206.htm

Geoengineering Solutions Could Prevent Irreversible Climate Crisis, Study Finds

ScienceDaily (Oct. 5, 2010) — Geoengineering could prevent the potentially catastrophic climate-change tipping points that loom just ahead, reports a new Cornell study.

Cornell earth system scientist Charles Greene, the lead author of the study published in the September-October issue of *Solutions* magazine (Vol. 1, No. 5), says time is running out, yet governments have done little to reverse rising carbon dioxide (CO_2) levels.

Many scientists warn that to avoid excessive warming, sea level rise and extreme weather, CO_2 in the atmosphere needs to be reduced to 350 parts-per-million (ppm) by the end of this century from the current level of around 390 ppm.

If actions aren't taken soon, ocean acidification and greenhouse warming in the atmosphere will reach a tipping point this century that will take more than 1,000 years to reverse, the paper warns.

It suggests that one way to reduce atmospheric CO_2 by the end of the century is by setting up fields of air-capture devices that absorb CO_2, very similar to the carbon capture and storage technology being developed for coal plants. The devices would use algal bioenergy as a power source to capture, extract and pipe CO_2 for storage or industrial use. Algae provide a preferred bioenergy source relative to land plants because they are more productive, more efficient in their use of nutrients and do not need to compete with food crops for prime agricultural land, Greene said.

The price tag for using this technology over the remainder of the century? Some $85.5 trillion to remove the 855 gigatons of carbon needed to bring atmospheric CO_2 down to 350 ppm.

Although $85.5 trillion seems high, it is comparable to the estimated cost of using carbon emission reduction strategies to reduce atmospheric CO_2 down to a lesser goal of 450 ppm, according to the paper. Corresponding to less than 1 percent of the global GDP for the rest of the century, such a cost is considered affordable compared with the alternative consequences of catastrophic climate change.Still, it will take decades to develop air capture and algal bioenergy systems, scale up prototypes, prepare underground carbon repositories and deploy such systems on a global scale.

"In an ideal case, we could have full deployment on a global scale by 2050," said Greene.To buy time, another geoengineering strategy that many scientists are exploring involves altering the Earth's radiation budget by injecting sulfate aerosols into the atmosphere and blocking the sun's rays, mimicking what happens after a volcanic eruption, says the paper. Other strategies involve injecting seawater droplets into clouds and deploying shades or mirrors in space, all to block the sun's rays from reaching Earth's surface.

Such solar radiation management strategies "can be done quickly, but should only be considered as a last resort to buy ourselves some time" since they simply "cover up the problem without doing anything about the CO_2," said Greene.The paper's co-authors include Bruce Monger, a senior research associate in earth and atmospheric sciences at Cornell, and Mark Huntley, the chief scientific officer for Cellana LLC in Kona, Hawaii.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Cornell University**. The original article was written by Krishna Ramanujan, ksr32@cornell.edu.

http://www.sciencedaily.com/releases/2010/10/101005164939.htm

Top Reasons for Facebook Unfriending

ScienceDaily (Oct. 5, 2010) — With over 500 million users worldwide, Facebook has become a global phenomenon, a vast cyber neighborhood where friends meet to share photos, news and gossip. But when those relationships sour, another phenomenon often occurs -- unfriending.

In what may be the first comprehensive study of its kind, a University of Colorado Denver Business School student has revealed the top reasons for Facebook unfriending, who is unfriended and how they react to being unfriended.

"Researchers spend a lot of time examining how people form friendships online but little is known on how those relationships end," said Christopher Sibona, a PhD student in the Computer Science and Information Systems program whose research will be published January by the *Hawaii International Conference on System Sciences*. "Perhaps this will help us develop a theory of the entire cycle of friending and unfriending."

After surveying more than 1,500 Facebook users on Twitter, Sibona found the number-one reason for unfriending is frequent, unimportant posts.

"The 100th post about your favorite band is no longer interesting," he said.

The second reason was posting about polarizing topics like religion and politics.

"They say not to talk about religion or politics at office parties and the same thing is true online," he said.

Inappropriate posts, such as crude or racist comments, were the third reason for being unfriended.

The study showed 57 percent of those surveyed unfriended for online reasons, while 26.9 percent did so for offline behavior.

Sibona found a sort of online hierarchy of dominant and subordinate relationships. For example, those making friend requests stood a much higher chance of being abruptly unfriended.

At the same time, those doing the unfriending seemed to hold the upper hand in the relationship.

It's a delicate dance with its own rules or "nettiquette," far different from face-to-face interaction.

"There is a lot more nuance in the offline friendship world. You don't have to go up to someone and ask them to be your friend," Sibona said. "That's not the case online. It can be awkward."

An AOL study showed 30 percent of teenagers wanted to unfriend their own parents. Sibona found two users who actually did this. One later refriended his mom but put her on a limited profile so he could manage her online interactions.

While some respondents reported being deeply hurt at being unfriended, others were more amused than traumatized.

"There are a wide variety of reactions depending on who did the unfriending and why," he said.

Facebook , founded in 2004 by Mark Zuckerberg, is so ingrained in popular culture that in 2009 unfriend was named word of the year by the New Oxford American Dictionary, which defined it as "to remove someone as a `friend' from a social networking site such as Facebook." A movie about Zuckerberg, The Social Network, was released last week.

Given the public nature of Facebook profiles, Sibona urged users to exercise caution in their posting behaviors citing a 2010 survey showing that 54.6 percent of recruiters used the site to find or investigate job candidates.

"The same kinds of posts that could get you unfriended might also be viewed negatively by recruiters," he said.

Steven Walczak, associate professor of Information Systems at the University of Colorado Denver Business School and Sibona's advisor, said he hopes the study will spark further research.

"With businesses embracing Facebook as a marketing and customer-relationship tool, this will hopefully create new research that further examines how social networks enhance business decision making and outcomes," he said.

Story Source:

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

http://www.sciencedaily.com/releases/2010/10/101005121822.htm

Amino Acid Supplement Makes Mice Live Longer

ScienceDaily (Oct. 5, 2010) — When mice are given drinking water laced with a special concoction of amino acids, they live longer than your average mouse, according to a new report in the October issue of *Cell Metabolism,* a Cell Press publication. The key ingredients in the supplemental mixture are so-called branched-chain amino acids, which account for 3 of the 20 amino acids (specifically leucine, isoleucine, and valine) that are the building blocks of proteins.

"This is the first demonstration that an amino acid mixture can increase survival in mice," said Enzo Nisoli of Milan University in Italy, noting that researchers last year showed that leucine, isoleucine, and valine extend the life span of single-celled yeast.

In the new study, the researchers gave middle-aged, male mice extra branched-chain amino acids (BCAA) in their drinking water. The animals were otherwise healthy and eating standard mouse chow.

Animals that were given the extra amino acids over a period of months lived longer, with a median life span of 869 days compared to 774 days for untreated control animals, the researchers report. That's an increase of 12 percent.

Those survival gains were accompanied by an increase in mitochondria in cardiac and skeletal muscles. Mitochondria are the cellular components responsible for powering cells. The supplement-fed mice also showed increased activity of SIRT1, a well-known longevity gene, and of the defense system that combats free radicals. They therefore showed fewer signs of oxidative damage.

The benefits of the amino acid supplements appear similar to those earlier ascribed to calorie restriction, Nisoli said.

Treated animals also showed improvements in their exercise endurance and in motor coordination, the researchers report. (It is important to note that the animals in the current study were all male, Nisoli said. They plan to test the effects in females in future studies.)

The findings in older mice suggest that the supplementary mixture may be specifically beneficial for those who are elderly or ill. "It may not be useful in young people or body builders," who are already in good condition, he said. But it might be a useful preventive strategy, he added, emphasizing that the mice they studied "were just aged, not sick."

Nisoli emphasized that consuming amino acid supplements is different from consuming proteins containing those amino acids. That's because they do not have to be digested, and can enter the bloodstream immediately. "They come with no energy cost."

He suspects that BCAA nutritional supplements may prove to be particularly helpful for people with heart failure, the muscle-wasting condition known as sarcopenia, chronic obstructive pulmonary disease, or other conditions characterized by energy defects. In fact, there are already some small studies in human to support that idea and BCAA supplements are already available for purchase in several countries, including Italy.

The challenge, Nisoli says, will be convincing clinicians that these supplements might be a benefit to their patients. He says a large clinical trial is needed, but there is little incentive for companies to do such trials for dietary supplements as opposed to drugs.

Overall, Nisoli said the new work supports a "general philosophy of a nutritional approach to disease, aging, and problems of energy status."

The researchers include Giuseppe D'Antona, Pavia University, Pavia, Italy; Maurizio Ragni, Milan University, Milan, Italy; Annalisa Cardile, Milan University, Milan, Italy; Laura Tedesco, Milan University, Milan, Italy, Brescia University, Brescia, Italy; Marta Dossena, Milan University, Milan, Italy, Brescia University, Brescia, Italy; Flavia Bruttini, Pavia University, Pavia, Italy; Francesca Caliaro, Pavia University, Pavia, Italy; Giovanni Corsetti, Brescia University, Brescia, Italy; Roberto Bottinelli, Pavia University, Pavia, Italy; Michele O. Carruba, Milan University, Milan, Italy, Brescia University, Brescia, Italy; Alessandra Valerio, Milan University, Milan, Italy, Brescia University, Brescia, Italy; and Enzo Nisoli, Milan University, Milan, Italy, Brescia University, Brescia, Italy.

Story Source:

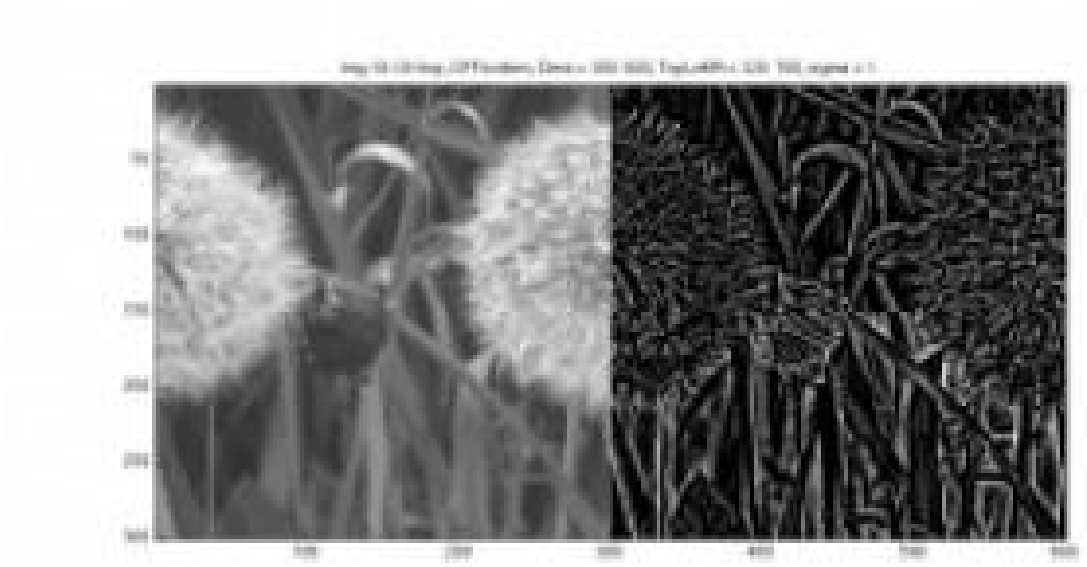
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Cell Press**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Giuseppe D'Antona, Maurizio Ragni, Annalisa Cardile, Laura Tedesco, Marta Dossena, Flavia Bruttini, Francesca Caliaro, Giovanni Corsetti, Roberto Bottinelli, Michele O. Carruba, Alessandra Valerio, Enzo Nisoli. **Branched-Chain Amino Acid Supplementation Promotes Survival and Supports Cardiac and Skeletal Muscle Mitochondrial Biogenesis in Middle-Aged Mice**. *Cell Metabolism*, Volume 12, Issue 4, 362-372, 6 October 2010 DOI: 10.1016/j.cmet.2010.08.016

http://www.sciencedaily.com/releases/2010/10/101005121710.htm

The World Is Full of Darkness, Reflected in the Physiology of the Human Retina



Dandelions rectified into bright/dark contrasts. More intense pixels correspond to stronger contrasts. (Credit: Univ. of Pennsylvania)

ScienceDaily (Oct. 5, 2010) — Physicists and neuroscientists from the University of Pennsylvania have linked the cell structure of the retina to the light and dark contrasts of the natural world, demonstrating the likelihood that the neural pathways humans use for seeing are adapted to best capture the world around us.

Researchers found that retinal ganglion cells that see darkness are more numerous and cluster closer together than those that see light, corresponding to the fact that the natural world contains more dark spots than light. Now physicists, and not just pessimists, see the world for the dark place it is.

The results suggest that the brain's separation of retinal circuitry into *off* and *on* mosaics that separately process dark and bright spots allows for structural adaptation to the natural scenes humans must see.

The team took the study a step further by constructing artificial images that matched the characteristics of the natural world and by testing what sorts of *off and on* mosaics best represented information from these images. According to the authors, the total flow of information peaked for mosaics with more densely clustered *off* cells, as in the human retina, suggesting that human vision has evolved to efficiently represent visual information in the natural world.

Researchers looked at the physiology of the retinal ganglion cells whose job it is to respond to a dark spot on a brighter background, simply called *off* cells, wondering why the brain would have clusters of *off* cells and not an even distribution across the retina. In addition to being more numerous and branching together in dense, bushy clusters, they also have smaller dendritic fields than the cells responsible for seeing light spots. By branching together more densely in clusters, they collect more synapses per visual angle. Thus, researchers concluded that the retina devotes more resources to processing dark contrasts, a natural capability reflected in the fact that there is more dark information in the world around us.

Researchers tested the hypothesis by measuring the spatial contrasts in natural images and quantifying the distribution of lightness and darkness. At all scales, the authors found that natural images contain relatively more dark contrasts than light.

"Photoreceptors respond to light," Vijay Balasubramanian, professor of physics and the study's lead author, said. "But a couple of layers deeper down in the retina, cells are responding to changes and differences in the amount of light across the image. The eye is not a digital camera, recording little pixels. The eye doesn't do that. The eye tells the brain that there are differences in light between neighboring points. The brain learns about contrast. And in this case, there is about twice as much brain activity responding to darker spots."

The team confirmed this across a range of spatial scales and traced the origin of this phenomenon to the statistical structure of natural scenes. Researchers showed that the optimal mosaics for encoding natural images are also asymmetric, with *off* elements smaller and more numerous, thus matching retinal structure. Finally, the concentration of synapses within a dendritic field matches the information content, suggesting a simple principle to connect a concrete fact of neuroanatomy with the abstract concept of "information": equal synapses for equal bits.

Researchers were interested in how the visual system is adapted to the physical structure of the world, an assumption that makes sense from an evolutionary standpoint. The physics of the natural world should correspond to the processing capabilities of the brain and there are many observable incidences of this phenomenon in the human and animal world. For example, frogs eat flies. That fact predicted that frog's eye contains "fly detectors." Flies, in turn, track potential mates in mid-air, predicting specialized neural fly circuits that detect other flies.

This study demonstrates the opposite case. Here, a particular feature of the human neural circuitry predicted a surprising property of the visual environment.

The study was conducted by Balasubramanian of the Department of Physics and Astronomy at Penn and the Department of Neuroscience at the University of Pennsylvania School of Medicine, Charles Ratliff of the Department of Physics and Astronomy at Penn and Bart Borghuis, YenHong Kao and Peter Sterling of the Department of Neuroscience at Penn Med.

The study, published in the *Proceedings of the National Academy of Sciences*, was supported by the National Institutes of Health and the National Science Foundation.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Pennsylvania**.

http://www.sciencedaily.com/releases/2010/10/101005121818.htm

Ancient Colorado River Flowed Backwards

ScienceDaily (Oct. 4, 2010) — Geologists have found evidence that some 55 million years ago a river as big as the modern Colorado flowed through Arizona into Utah in the opposite direction from the present-day river. Writing in the October issue of the journal *Geology*, they have named this ancient northeastward-flowing river the California River, after its inferred source in the Mojave region of southern California.

Lead author Steven Davis, a post-doctoral researcher in the Department of Global Ecology at the Carnegie Institution, and his colleagues* discovered the ancient river system by comparing sedimentary deposits in Utah and southwest Arizona. By analyzing the uranium and lead isotopes in sand grains made of the mineral zircon, the researchers were able to determine that the sand at both localities came from the same source -- igneous bedrock in the Mojave region of southern California.

The river deposits in Utah, called the Colton Formation by geologists, formed a delta where the river emptied into a large lake. They are more than 400 miles (700 kilometers) to the northeast of their source in California. "The river was on a very similar scale to the modern Colorado-Green River system," says Davis, "but it flowed in the opposite direction." The modern Colorado River's headwaters are in the Rocky Mountains, flowing southeast to the river's mouth in the Gulf of California.

The deposits of the Colton Formation are approximately 55 million years old. Recently, other researchers have speculated that rivers older than the Colorado River may have carved an ancestral or "proto" Grand Canyon around this time, long before Colorado began eroding the present canyon less than 20 million years ago. But Davis sees no evidence of this. "The Grand Canyon would have been on the river's route as it flowed from the Mojave to Utah, he says. "It stands to reason that if there was major erosion of a canyon going on we would see lots of zircon grains from that area, but we don't."

The mighty California River likely met its end as the Rocky Mountains rose and the northern Colorado Plateau tilted, reversing the slope of the land surface and the direction of the river's flow to create the present Colorado-Green River system. Davis and his colleagues have not determined precisely when the change occurred, however. "The river could have persisted for as long as 20 million years before the topography shifted enough to reverse its flow," he says.

* Authors: Steven J. Davis, Carnegie Institution; William R. Dickinson, University of Arizona; George E. Gehrels, University of Arizona; Jon E. Spencer, Arizona Geological Survey; Timothy F. Lawton, New Mexico State University; and Alan R. Carroll, University of Wisconsin.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Carnegie Institution**.

http://www.sciencedaily.com/releases/2010/10/101004112147.htm

Unemployment Linked With Child Maltreatment

ScienceDaily (Oct. 3, 2010) — The stresses of poverty have long been associated with child abuse and neglect. In a study presented Sunday, Oct. 3, at the American Academy of Pediatrics (AAP) National Conference and Exhibition in San Francisco, researchers directly linked an increased unemployment rate to child maltreatment one year later.

Researchers reviewed state-level unemployment statistics from the Bureau of Labor Statistics, and compared them with child maltreatment data from the National Child Abuse and Neglect Data System (NCANDS), during the years 1990 to 2008. Each 1 percent increase in unemployment was associated with at least a 0.50 per 1,000 increase in confirmed child maltreatment reports one year later. In addition, higher levels of unemployment appeared to raise the likelihood of child maltreatment, as it was not only the lagged change in unemployment, but also the previous year's unemployment level that influenced the number of child abuse cases.

According to the study, a prolonged rise in unemployment rates is not only detrimental to the economic health of the country but also to the physical and mental health of children. Maltreated children suffer the immediate physical consequences of abuse, including physical injury and even death, and are also at increased risk of physical and mental health effects, often lasting for decades.

Unemployment in the U.S. has risen from 4.5 percent in 2007 to a current level of 9.5 percent.

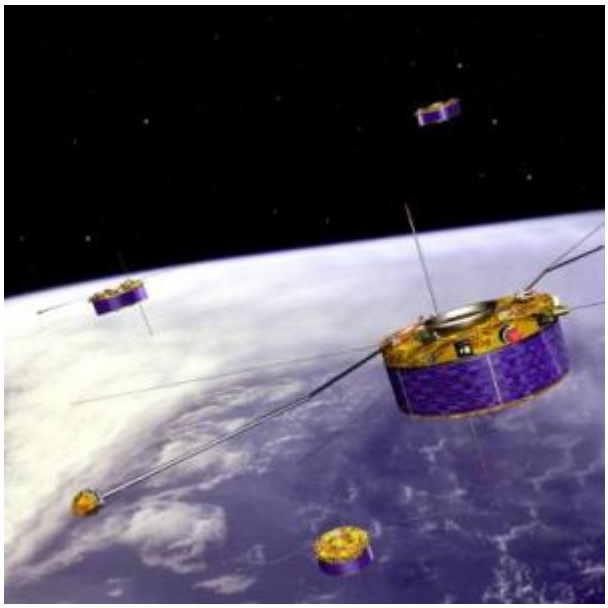
"When times are bad, children suffer," said study author Robert Sege, MD, PhD, FAAP, professor of pediatrics, Boston University School of Medicine, and director, Division of Ambulatory Pediatrics, Boston Medical Center. "These results suggest that programs to strengthen families and prevent maltreatment should be expanded during economic downturns."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **American Academy of Pediatrics**, via EurekAlert!, a service of AAAS.

http://www.sciencedaily.com/releases/2010/10/101003081452.htm

Cluster Helps Disentangle Turbulence in the Solar Wind



This is an artist's impression of the Cluster quartet. (Credit: ESA)

ScienceDaily (Oct. 4, 2010) — From Earth, the Sun looks like a calm, placid body that does little more than shine brightly while marching across the sky. Images from a bit closer, of course, show it's an unruly ball of hot gas that can expel long plumes out into space -- but even this isn't the whole story. Surrounding the Sun is a roiling wind of electrons and protons that shows constant turbulence at every size scale: long streaming jets, smaller whirling eddies, and even microscopic movements as charged particles circle in miniature orbits. Through it all, great magnetic waves and electric currents move through, stirring up the particles even more.

This solar wind is some million degrees Celsius, can move as fast as 750 kilometers (466 statute miles) per second, and -- so far -- defies a complete description by any one theory. It's hotter than expected, for one, and no one has yet agreed which of several theories offers the best explanation.

Now, the ESA/NASA Cluster mission -- four identical spacecraft that fly in a tight formation to provide 3-dimensional snapshots of structures around Earth -- has provided new information about how the protons in the solar wind are heated.

"We had a perfect window of 50 minutes," says NASA scientist Melvyn Goldstein, chief of the Geospace Physics Laboratory at NASA's Goddard Space Flight Center in Greenbelt, Md. and co-author of the new paper that appeared in *Physical Review Letters* on September 24. "It was a time when the four Cluster spacecraft were so close together they could watch movements in the solar wind at a scale small enough that it was possible to observe the heating of protons through turbulence directly for the first time."

Scientists know that large turbulence tends to "cascade" down into smaller turbulence -- imagine the sharply defined whitecaps on top of long ocean waves. In ocean waves, the energy from such cascades naturally adds a small amount of heat from friction as the particles shift past each other, thus heating the water slightly. But the fast, charged particles -- known as "plasma" -- around the sun don't experience that kind of friction, yet they heat up in a similar way.

"Unlike the usual fluids of everyday life," says Fouad Sahraoui, lead author of a new paper on the solar wind and a scientist at the CNRS-Ecole Polytechnique-UPMC in France, "plasmas possess electric and magnetic fields generated by the motions of proton and electrons. This changes much of the intuitive images that we get from observing conventional fluids."

Somehow the magnetic and electric fields in the plasma must contribute to heating the particles. Decades of research on the solar wind have been able to infer the length and effects of the magnetic waves, but direct observation was not possible before the Cluster mission watched large waves from afar. These start long as long wavelength fluctuations, but lose energy -- while getting shorter -- over time. Loss of energy in the waves transfer energy to the solar wind particles, heating them up, but the exact method of energy transfer, and the exact nature of the waves doing the heating, has not been completely established.

In addition to trying to find the mechanism that heats the solar wind, there's another mystery: The magnetic waves transfer heat to the particles at different rates depending on their wavelength. The largest waves lose energy at a continuous rate until they make it down to about 100-kilometer wavelength. They then lose energy even more quickly before they hit around 2-kilometer wavelength and return to more or less the previous rate. To tackle these puzzles, scientists used data from Cluster when it was in the solar wind in a position where it could not be influenced by Earth's magnetosphere.

For this latest paper, the four Cluster spacecraft provided 50 minutes of data at a time when conditions were just right -- the spacecraft were in a homogeneous area of the solar wind, they were close together, and they formed a perfect tetrahedral shape -- such that the instruments could measure electromagnetic waves in three dimensions at the small scales that affect protons.

The measurements showed that the cascade of turbulence occurs through the action of a special kind of traveling waves -- named Alfvén waves after Nobel laureate Hannes Alfvén, who discovered them in 1941.

The surprising thing about the waves that Cluster observed is that they pointed perpendicular to the magnetic field. This is in contrast to previous work from the Helios spacecraft, which in the 1970's examined magnetic waves closer to the sun. That work found magnetic waves running parallel to the magnetic field, which can send particles moving in tight circular orbits -- a process known as cyclotron resonance -- thus giving them a kick in both energy and temperature. The perpendicular waves found here, on the other hand, create electric fields that efficiently transfer energy to particles by, essentially, pushing them to move faster.

Indeed, earlier Cluster work suggested that this process -- known as Landau damping -- helped heat electrons. But, since much of the change in temperature with distance from the sun is due to changes in the proton temperature, it was crucial to understand how they obtained their energy. Since hot electrons do not heat protons very well at all, this couldn't be the mechanism.

That Landau damping is what adds energy to both protons and electrons -- at least near Earth -- also helps explain the odd rate change in wave fluctuations as well. When the wavelengths are about 100 kilometers or a bit shorter, the electric fields of these perpendicular waves heat protons very efficiently. So, at these lengths, the waves transfer energy quickly to the surrounding protons -- offering an explanation why the magnetic waves suddenly begin to lose energy at a faster rate. Waves that are about two kilometers, however, do not interact efficiently with protons because the electric fields oscillate too fast to push them. Instead these shorter waves begin to push and heat electrons efficiently and quickly deplete all the energy in the waves.

"We can see that not all the energy is dissipated by protons," Sahraoui said. "The remaining energy in the wave continues its journey toward smaller scales, wavelengths of about two kilometers long. At that point, electrons in turn get heated."

Future NASA missions such as the Magnetospheric Multiscale mission, scheduled for launch in 2014, will be able to probe the movements of the solar wind at even smaller scales.

Cluster recently surpassed a decade of passing in and out of our planet's magnetic field, returning invaluable data to scientists worldwide. Besides studying the solar wind, Cluster's other observations include studying the composition of the earth's aurora and its magnetosphere.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **NASA/Goddard Space Flight Center**.

http://www.sciencedaily.com/releases/2010/10/101004211740.htm

Scientist Compares Classical Singing to Traditional Indian Singing to Find Speech Disorder Treatment

Jessica Colwell, a student in the School of Health Professions, prepares to sing for Radhakrishnan as he studies the differences between vibrato, an involuntary pitch fluctuation in classical singing, and Taan, a voluntary pitch fluctuation in Hindustani singing. (Credit: Christian Basi/University of Missouri)

ScienceDaily (Oct. 5, 2010) — Hindustani singing, a North Indian traditional style of singing, and classical singing, such as the music of Puccini, Mozart and Wagner, vary greatly in technique and sound. Now, speech-language pathology researchers at the University of Missouri are comparing the two styles in hopes of finding a treatment for laryngeal tremors, a vocal disorder associated with many neurological disorders that can result in severe communication difficulties.

Sound is developed in the larynx, an organ located in the neck. A laryngeal or vocal tremor occurs when the larynx spasms during speech, creating a breathy voice featuring a constantly shifting pitch. People with Parkinson's disease and other similar disorders often display vocal tremors. Currently, speech-language pathologists are only able to help patients manage tremors. By understanding the physiology behind voluntary and involuntary pitch fluctuation, an MU researcher hopes to find a treatment.

"Hindustani and classical singing styles are very different," said Nandhu Radhakrishnan, professor of communication science and disorders in the School of Health Professions. "In Hindustani singing, performers use 'Taan' to modulate pitch voluntarily, while classical singers use vibrato to vary pitch involuntarily. With this knowledge, we may be able to develop a specific therapy to cure laryngeal tremors."

Radhakrishnan is the first researcher to study the physiology of Hindustani singing. He worked with Ronald Scherer of Bowling Green State University in Ohio, and Santanu Bandyopadhyay, a vocal teacher in West Bengal, India. In his study, he discovered several differences between Hindustani and classical singing. Primarily, Hindustani singing features a voluntary, rapid dip in pitch, which Radhakrishnan refers to as a

"Taan gesture." In contrast, classical singers use a vocal modulation like vibrato to make a smooth transition between pitches.

Classical singers use what is known as a singer's formant to enhance a specific range of frequency that will be pleasing to the ear by lowering their larynx and widening the vocal tract. However, Hindustani singers do not use a singer's formant. Without this, Hindustani singers perform at a much lower volume than classical singers, and their singing voice sounds very similar to their speaking voice. Radhakrishnan also observed that Hindustani singing requires precise pronunciation of lyrics, whereas notes guide pronunciation in classical music.

To uncover the secrets of Hindustani singing, Radhakrishnan recorded a traditional Indian singing teacher repeatedly performing a single Taan gesture. Although singers usually perform several of these pitch fluctuations in succession, Radhakrishnan recorded just one gesture to isolate the technique for scientific study. Radhadrishnan used equipment that measures variables like lung pressure, the duration that vocal folds are open and closed, and the rate at which air is flowing out of the larynx.

The study was published recently in the *Journal of Voice*. In the coming months, Radhakrishnan will publish another study on Taan gestures that focuses on performance aspects of the technique.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Missouri-Columbia**.

http://www.sciencedaily.com/releases/2010/10/101004211742.htm

Scientists Discover That Inflammation Helps to Heal Wounds

ScienceDaily (Oct. 5, 2010) — A new research study published in The *FASEB Journal* may change how sports injuries involving muscle tissue are treated, as well as how much patient monitoring is necessary when potent anti-inflammatory drugs are prescribed for a long time. That's because the study shows for the first time that inflammation actually helps to heal damaged muscle tissue, turning conventional wisdom on its head that inflammation must be largely controlled to encourage healing.

These findings could lead to new therapies for acute muscle injuries caused by trauma, chemicals, infections, freeze damage, and exposure to medications which cause muscle damage as a side effect. In addition, these findings suggest that existing and future therapies used to combat inflammation should be closely examined to ensure that the benefits of inflammation are not eliminated.

"We hope that our findings stimulate further research to dissect different roles played by tissue inflammation in clinical settings, so we can utilize the positive effects and control the negative effects of tissue inflammation," said Lan Zhou, M.D., Ph.D., a researcher involved in the work from the Neuroinflammation Research Center/Department of Neurosciences/Lerner Research Institute at the Cleveland Clinic in Ohio.

Zhou and colleagues found that the presence of inflammatory cells (macrophages) in acute muscle injury produce a high level of a growth factor called insulin-like growth factor-1 (IGF-1) which significantly increases the rate of muscle regeneration. The research report shows that muscle inflammatory cells produce the highest levels of IGF-1, which improves muscle injury repair. To reach this conclusion, the researchers studied two groups of mice. The first group of mice was genetically altered so they could not mount inflammatory responses to acute injury. The second group of mice was normal. Each group experienced muscle injury induced by barium chloride. The muscle injury in the first group of mice did not heal, but in the second group, their bodies repaired the injury. Further analysis showed that macrophages within injured muscles in the second group of mice produced a high level of IGF-1, leading to significantly improved muscle repair.

"For wounds to heal we need controlled inflammation, not too much, and not too little," said Gerald Weissmann, M.D., Editor-in-Chief of The *FASEB Journal*, "It's been known for a long time that excess anti-inflammatory medication, such as cortisone, slows wound healing. This study goes a long way to telling us why: insulin-like growth factor and other materials released by inflammatory cells helps wound to heal."

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Federation of American Societies for Experimental Biology**, via EurekAlert!, a service of AAAS.

1. H. Lu, D. Huang, N. Saederup, I. F. Charo, R. M. Ransohoff, L. Zhou. **Macrophages recruited via CCR2 produce insulin-like growth factor-1 to repair acute skeletal muscle injury**. *The FASEB Journal*, 2010; DOI: 10.1096/fj.10-171579

http://www.sciencedaily.com/releases/2010/10/101004130105.htm

Climate Change Hits Southeast Australia Fish Species

The Maugean Skate – currently listed as Endangered by the IUCN Red List of Threatened Animals. (Credit: CSIRO)

ScienceDaily (Oct. 5, 2010) — Scientists are reporting significant changes in the distribution of coastal fish species in south-east Australia which they say are partly due to climate change.

CSIRO's Climate Adaptation and Wealth from Oceans Flagships have identified 43 species, representing about 30 per cent of the inshore fish families occurring in the region, that exhibited shifts thought to be climate-related.

These include warm temperate surf-zone species such as Silver Drummer and Rock Blackfish that are breeding and have become more abundant, and range increases in Snapper and Rock Flathead. There is also a greater abundance of warm water tunas and billfishes and occasional visits from Queensland Groper and Tiger Sharks.

"Furthermore, up to 19 species, or 5 per cent, of Tasmanian coastal fish fauna have undergone serious declines or are possibly extinct locally," says the Curator of the Australian National Fish Collection, Dr Peter Last. "At the same time many warm temperate species have moved in and colonised the cool temperate Tasmanian region.

"Shifts in the distribution of marine animals in response to climate change can be detrimental to some species. The problem is that in southern Tasmania, shallow cold water species have nowhere to escape warmer conditions in the sea," Dr Last says.

Particularly at risk are species such as the Maugean Skate, which is now confined to Port Davey and Macquarie Harbour in Tasmania's southwest.

Dr Last and his colleagues from CSIRO and the Tasmanian Aquaculture and Fisheries Institute outline the changes in a research paper published in the journal *Global Ecology and Biogeography.*

Their data come from a range of sources -- published accounts, scientific surveys, spearfishing and angling competitions, commercial catches and underwater photographic records -- from the late 1800s to the present.

The findings support information provided in Australia's first Marine Climate Change Impacts Report Card, released in 2009, which describes recorded and projected changes to marine species from shifts in climate.

Dr Last says south-eastern Australia is a climate change hotspot with well-documented changes already occurring over the past 70 years, including; southward penetration of the East Australian Current by about 350 kilometres and a temperature rise of almost 2ºC.

"Increased water temperatures in the Tasman Sea are likely to have a cascading effect through local marine ecosystems and, for example, the Bass Strait islands act as stepping stones or distributional pathways south. Already we are seeing biological responses to these changes in the increased presence of sea urchins and fishes from further north."

Co-authors of the paper were: CSIRO's Will White, Dan Gledhill and Alistair Hobday, and Rebecca Brown, Graham Edgar and Gretta Pecl from the Tasmanian Aquaculture and Fisheries Institute at the University of Tasmania.

Story Source:

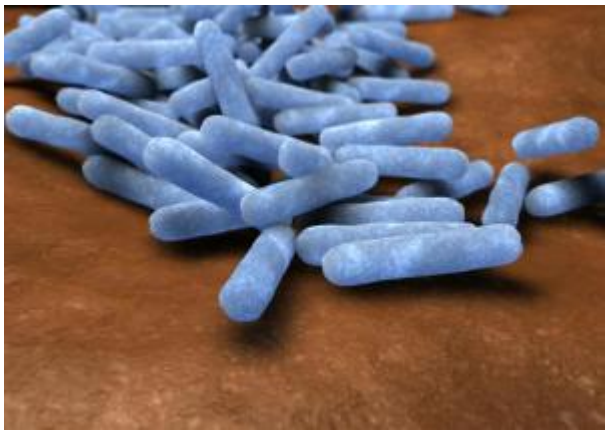
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **CSIRO Australia**.

Journal Reference:

1. Peter R. Last, William T. White, Daniel C. Gledhill, Alistair J. Hobday, Rebecca Brown, Graham J. Edgar, Gretta Pecl. **Long-term shifts in abundance and distribution of a temperate fish fauna: a response to climate change and fishing practices**. *Global Ecology and Biogeography*, 2010; DOI: 10.1111/j.1466-8238.2010.00575.x

http://www.sciencedaily.com/releases/2010/09/100928092839.htm

Microbes Engineered for Low-Cost Production of Anti-Cancer Drug, Taxol



Artist's 3-D rendering of E. coli bacteria. (Credit: iStockphoto/Roberto Saporito)

ScienceDaily (Oct. 5, 2010) — MIT researchers and collaborators from Tufts University have now engineered E. coli bacteria to produce large quantities of a critical compound that is a precursor to the cancer drug Taxol, originally isolated from the bark of the Pacific yew tree. The tree's bacteria can produce 1,000 times more of the precursor, known as taxadiene, than any other engineered microbial strain.

The technique, described in the Oct. 1 issue of *Science*, could bring down the manufacturing costs of Taxol and also help scientists discover potential new drugs for cancer and other diseases such as hypertension and Alzheimer's, said Gregory Stephanopoulos, who led the team of MIT and Tufts researchers and is one of the senior authors of the paper.

"If you can make Taxol a lot cheaper, that's good, but what really gets people excited is the prospect of using our platform to discover other therapeutic compounds in an era of declining new pharmaceutical products and rapidly escalating costs for drug development," said Stephanopoulos, the W.H. Dow Professor of Chemical Engineering at MIT.

Taxol, also known as paclitaxel, is a powerful cell-division inhibitor commonly used to treat ovarian, lung and breast cancers. It is also very expensive -- about $10,000 per dose, although the cost of manufacturing that dose is only a few hundred dollars. (Patients usually receive one dose.)

Two to four Pacific yew trees are required to obtain enough Taxol to treat one patient, so in the 1990s, bioengineers came up with a way to produce it in the lab from cultured plant cells, or by extracting key intermediates from plant material like the needles of the decorative yew. These methods generate enough material for patients, but do not produce sufficient quantities for synthesizing variants that may be far more potent for treating cancer and other diseases. Organic chemists have succeeded in synthesizing Taxol in the lab, but these methods involve 35 to 50 steps and have a very low yield, so they are not economical. Also, they follow a different pathway than the plants, which makes it impossible to produce the pathway intermediates and change them to make new, potentially more powerful variations.

"By mimicking nature, we can now begin to produce these intermediates that the plant makes, so people can look at them and see if they have any therapeutic properties," said Stephanopoulos. Moreover, they can synthesize variants of these intermediates that may have therapeutic properties for other diseases.

The complex metabolic sequence that produces Taxol involves at least 17 intermediate steps and is not fully understood. The team's goal was to optimize production of the first two Taxol intermediates, taxadiene and taxadien-5-alpha-ol. E. coli does not naturally produce taxadiene, but it does synthesize a compound called IPP, which is two steps away from taxadiene. Those two steps normally occur only in plants. MIT postdoctoral associate Ajikumar Parayil recognized that the key to more efficient production is a well-integrated pathway that does not allow potentially toxic intermediates to accumulate. To accomplish this, researchers took a two-pronged approach in engineering E. coli to produce taxadiene.

First, the team focused on the IPP pathway, which has eight steps, and determined that four of those reactions were bottlenecks in the synthesis -- that is, there is not enough enzyme at those steps, so the entire process is slowed down. Parayil then engineered the bacteria to express multiple copies of those four genes, eliminating the bottlenecks and speeding up IPP production.

To get E. coli to convert IPP to taxadiene, the researchers added two plant genes, modified to function in bacteria, that code for the enzymes needed to perform the reactions. They also varied the number of copies of the genes to find the most efficient combination. These methods allowed the researchers to boost taxadiene production 1,000 times over levels achieved by other researchers using engineered E. coli, and 15,000 times over a control strain of E. coli to which they just added the two necessary plant genes but did not optimize gene expression of either pathway.

Following taxadiene synthesis, researchers advanced the pathway by adding one more critical step towards Taxol synthesis, the conversion of taxadiene to taxadiene 5-alpha-ol. This is the first time that taxadiene-5-alpha-ol has been produced in microbes. There are still several more steps to go before achieving synthesis of the intermediate baccatin III, from which Taxol can be chemically synthesized. "Though this is only a first step, it is a very promising development and certainly supports this approach and its potential," said Blaine Pfeifer, assistant professor of chemical and biological engineering at Tufts and an author of the Science paper.

Now that the researchers have achieved taxadiene synthesis, there are still another 15 to 20 steps to go before they can generate Taxol. In this study, they showed that they can perform the first of those steps.Stephanopoulos and Pfeifer expect that if this technique can eventually be used to manufacture Taxol, it would reduce significantly the cost to produce one gram of the drug. Researchers could also experiment with using these bacteria to create other useful chemicals such as fragrances, flavors and cosmetics, said Pfeifer.

Development of the new technology was funded by the Singapore-MIT Alliance, National Institutes of Health and a Milheim Foundation Grant for Cancer Research. MIT has filed a patent on the technology and new strain of E. coli, and the researchers are considering licensing the technology or starting a new company to commercialize it, said Stephanopoulos.

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Massachusetts Institute of Technology**. The original article was written by Anne Trafton, MIT News Office.

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1. Parayil Kumaran Ajikumar, Wen-Hai Xiao, Keith E. J. Tyo, Yong Wang, Fritz Simeon, Effendi Leonard, Oliver Mucha, Too Heng Phon, Blaine Pfeifer, and Gregory Stephanopoulos. **Isoprenoid Pathway Optimization for Taxol Precursor Overproduction in Escherichia coli**. *Science*, Vol. 330. no. 6000, pp. 70 - 74 DOI: 10.1126/science.1191652

http://www.sciencedaily.com/releases/2010/09/100930142727.htm

Birth Pangs

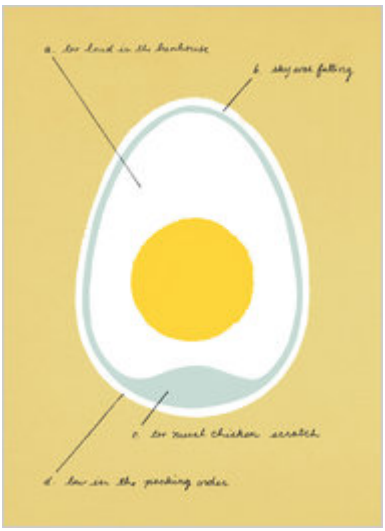
By JEROME GROOPMAN

ORIGINS

How the Nine Months Before Birth Shape the Rest of Our Lives

By Annie Murphy Paul

306 pp. Free Press. $26



After the birth of each of our three children, my wife and I breathed a deep sigh of relief. We had been meticulous in following our obstetrician's advice: we had been screened for the Tay-Sachs trait, and had an amniocentesis to check for chromosomal changes associated with Down syndrome, and ultrasound to assess the fetus's growth. Everything looked normal. But with the acute awareness of two physicians, we knew that these tests did not reveal all the problems that can occur during gestation. So when we heard the piercing cry of our newborn and were told the baby had a high Apgar score, we believed we had successfully skirted the perils of pregnancy.

But in the decades since our children's birth, results from research studies have suggested that we do not put fetal life so readily behind us. Rather, as Annie Murphy Paul writes in her informative and wise new book, "fetal origins research suggests that the lifestyle that influences the development of disease is often not only the one we follow as adults, but the one our mothers practiced when they were pregnant with us as well." This hypothesis was initially put forth by David Barker, a British physician who in 1989 published data indicating that poor maternal nutrition put offspring at risk for heart disease decades later.

Barker's hypothesis was initially dismissed by the medical establishment as an artifact of looking in hindsight at birth-weight and the later development of disease, without detailed knowledge of what happened in the interim. Of necessity, research on fetal development involves observing pregnant women in their daily lives; no one would purposefully have one group eat in a possibly risky way or be exposed to a potentially

dangerous substance, and compare outcomes with an unperturbed control group. We have, at best, only correlations between a mother's lifestyle and her child's future health, not clear causation. Nonetheless, a growing number of observational studies conducted in different parts of the world since Barker's initial report bolster the notion that in the nature-nurture dynamic, nurture begins at the time of conception. The food the mother eats, the air she breathes, the water she drinks, the stress or trauma she experiences — all may affect her child, for better or worse, over the decades to come.

Of course, the Barker hypothesis risks bringing the normal simmering anxieties of pregnancy to a neurotic boil. Paul, previously the author of "The Cult of Personality," a critical look at personality testing, notes that fetal origins research is often covered in a "sensational and scolding" way in the media, "cast as one long ringing alarm bell."

To her credit, she steers away from such sensationalism. Structuring her exploration of the subject around the nine months of her own (second) pregnancy, she provides a balanced, common-sense view of an emerging field of uncertain science.

Paul leavens the normal concerns of pregnancy with wry humor. In her chapter on the impact of maternal diet, she recalls that "during my first pregnancy, I signed up to get weekly e-mails from a parenting Web site. Each Saturday a message would appear in my in-box informing me of my fetus's current size, invariably described in terms of something edible. At nine weeks, I learned, my fetus was as big as a grape; at 17 weeks, a turnip; at 19 weeks, a 'large heirloom tomato.' The implication was clear: your baby is what you eat, and your baby had better not be the shape of a 'Twinkie.' "

Paul discusses the considerable evidence that maternal overeating might predispose a baby to diabetes and other hormonal disorders. But could a mother's taste in, say, breakfast, also influence her child's gender? Paul presents research from Fiona Mathews of the University of Exeter and two colleagues from Oxford University indicating that women who eat cereal every morning have a higher chance of delivering boys. "The fact that many young women of reproductive age skip breakfast or consume low-calorie diets in order to keep their weights down . . . could help explain the falling rate of male birth," Paul writes. But then she turns to Stanley Young, a statistician at the National Institute of Statistical Sciences, an independent institute based in the Research Triangle of North Carolina, who is scathing in his analysis of the findings from Britain. Young points out that if you ask subjects enough questions — Mathews's study asked about more than 100 different food items — you will find some statistically significant relationship, simply by chance. These kinds of results, Young has written, "should be viewed with some skepticism, since the human imagination seems capable of developing a rationale from most findings, however unanticipated." Mathews defends her work, and while the scientific duel goes on, Paul smartly concludes: "Perhaps these posited explanations have merit, or perhaps they are modern-day versions of the folklore that surrounds so much of pregnancy, and fetal sex in particular. For now, I file them away, along with the fact that I eat a bowl of raisin bran every morning." (Her second child, it turns out, is a boy.)

Over her nine months and nine chapters, Paul touches on some highly charged subjects, like the potential effects of maternal lifestyle on a child's temperament, I.Q. and sexual preference. (While exposure to certain chemicals and pollutants may affect cognitive development, any impact of maternal lifestyle on temperament and sexual preference is far from clear or convincing.) She also looks at the impact of emotional distress. Researchers have studied the effects of various traumatic events, from the Northridge earthquake to Hurricane Katrina to the Holocaust, and have often found striking effects. One study of people born in Jerusalem indicate that those who were in their second month of gestation in June 1967, the time of the Arab-Israeli Six-Day War, were more likely to develop schizophrenia as young adults.

Researchers term such extreme events "natural experiments" because they affect every pregnant woman in a given community (those who are "troubled" from the start as well as those who are psychologically healthy);

occur within a discrete period of time; and can be matched with the gestational age of the fetus. As Paul points out, they are "the next best thing to a traditional scientific experiment, in which subjects can be randomly assigned to one condition or another." But the results are still confounded by the fact that numerous other events that are not reported or recalled may also account for the outcome.

Throughout "Origins," Paul consistently hews a middle ground between dismissive skepticism and blind acceptance of research results. In her chapter on stress, she quotes Calvin Hobel, an obstetrician at Cedars-Sinai Medical Center in Los Angeles, who asserts that even ordinary stress can have deleterious effects, like premature labor or low birth-weight. But Janet DiPietro, a development expert at Johns Hopkins, takes the opposite view, pointing out that the placenta breaks down the stress hormone cortisol in the woman's blood, preventing most of it from reaching the fetus. "Most pregnant women can stop worrying about stress hurting their fetuses," she tells Paul. And moderate stress may actually be good for the fetus. According to one of her studies, women who reported moderate daily anxiety and stress during pregnancy had children who scored higher in tests of motor and mental development at age 2. A more recent (and unpublished) study of Di-Pietro's suggests a biological mechanism: the 2-week-old infants of women who experience relatively more stress during pregnancy showed faster neural conduction, "evidence of a more mature brain." Paul puts stress into what she calls the "profoundly unsatisfying" category of "it depends." "Most people, pregnant women and their fetuses likely included, do best when they have a moderate but manageable amount of stress in their lives," she writes. But "such nuance is seldom found in the public discussion of stress during pregnancy, where fear and anxiety rule," Paul writes.

Paul extends this point-counterpoint approach to her own work. After she wrote an article in The New York Times Magazine about the possible connection between maternal obesity and the child's obesity later in life, Darshak Sanghavi, a pediatric cardiologist at the University of Massachusetts, took her to task in Slate for contributing to a "blame the victim" mentality that reduces complex social and public health problems to a matter of "failed gestation." (He also cited the "hysteria" over so-called crack babies — an example that Paul takes on in her book, noting that the long-term effects of fetal exposure to crack have turned out to be far more subtle than those of exposure to alcohol and tobacco.) Paul writes how she invited Sanghavi out to breakfast, and here makes it clear that she does not believe that the new data on the fetal origins of adult disease means we should give up on trying to improve lives after birth. "Prenatal experience doesn't force the individual down a particular path," she writes. "At most, it points us in a general direction, and we can take another route if we choose. Imagine water flowing downstream: prenatal influences might dig a canal, so to speak, making it easier for the water to flow one way rather than another." With effort, "we may be able to channel our fates in a different direction. The theory of fetal origins ought to contribute to complexity, not reduce it; if we take care in how we think about prenatal influences, they may add another layer to our understanding of who we are and how we got to be this way."

The science she describes may be ambiguous, but on this point Paul is absolutely right: there is so much that can change after a child enters your arms.

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http://www.nytimes.com/2010/10/03/books/review/Groopman-t.html?_r=1&nl=books&emc=booksupdateema1

Learning to Be Lincoln
By DAVID S. REYNOLDS

THE FIERY TRIAL

Abraham Lincoln and American Slavery

By Eric Foner

By Illustrated. 426 pp. W. W. Norton & Company. $29.95

Do we need yet another book on Lincoln, especially in the wake of all the Lincoln volumes that appeared last year in commemoration of the 200th anniversary of his birth? Well, yes, we do — if the book is by so richly informed a commentator as Eric Foner, the DeWitt Clinton professor of history at Columbia. Foner tackles what would seem to be an obvious topic, Lincoln and slavery, and manages to cast new light on it.

Foner has long been deliberating about Lincoln. He is, most recently, the editor of a collection of essays, "Our Lincoln: New Perspectives on Lincoln and His World," and among his previous books are a seminal one on the rise of the Republican Party, "Free Soil, Free Labor, Free Men," and another, "Reconstruction: America's Unfinished Revolution, 1863-1877," in which Lincoln's fledgling policies toward the defeated South were revised in the decade just after the Civil War.

Having probed the politics of the Civil War era, Foner is in a strong position to offer what amounts to a political biography of Lincoln. His approach in "The Fiery Trial" underscores the usefulness of contextual study. Many of history's leading figures, from Shakespeare and Beethoven through American presidents to popular entertainers, have been written about endlessly by traditional biographers. But barring the discovery of new letters, long-hidden diaries or the like, fresh information is hard to find about eminent people whose every small motion has been put under the biographical microscope.

Recent years have witnessed books on Lincoln's marriage, his supposed homosexuality, and his melancholia and occasional temper tantrums. Such books are often fascinating and provocative, but their originality and reliability can vary greatly, since no new cache of private Lincolniana has recently come to light. Fortunately,

there's a way of re-envisioning even the most famous people: by freshly examining their relationship to their historical contexts. The great figures of history, as Melville wrote, "are parts of the times; they themselves are the times, and possess a correspondent coloring."

Lincoln was no exception. By venturing into Lincoln's contexts, Foner doesn't choose the direction of, say, military history or popular culture or sexual mores. Instead, he keeps sharply focused on Lincoln's political background. This is a wise move since Lincoln was a politician to the core.

Because of his broad-ranging knowledge of the 19th century, Foner is able to provide the most thorough and judicious account of Lincoln's attitudes toward slavery that we have to date. Historians have long been puzzled by apparent inconsistencies. One the one hand, Lincoln was the Great Emancipator. There's no reason to doubt his declaration: "I am naturally antislavery. If slavery is not wrong, nothing is wrong." On the other hand, he had a racist streak. He used the words "nigger" and "darky" in conversation, and he thought that blacks, whom he regarded as physically different from whites, should be deported to Liberia, Central America or somewhere else, since they couldn't live on equal terms with whites in America. No one was more eloquent than Lincoln in describing the injustice of the institution of slavery; yet rarely did he dwell on the actual sufferings of America's four million enslaved blacks.

Foner reveals that these contradictions were part and parcel of Lincoln's upbringing and his participation in party politics. Born in 1809 in the slave state of Kentucky, Lincoln was taken at 7 to live in southwestern Indiana, a region, Foner informs us, that was moderate in its views of slavery but pervaded by racism. Lincoln's later move to Illinois immersed him in a milieu that coupled tepid antislavery politics with, again, fierce racial prejudice.

Then came Lincoln's political service in the Whig Party, which contained a range of factions, from fire-eating Southern planters to antislavery New Englanders. Lincoln's wife, Mary Todd, belonged to a family of slaveholders. His political idol, Henry Clay, was himself a man of contradiction: he was a Kentucky slave owner who accepted the hidebound racial views of the time, yet looked forward to a day when the nation's enslaved blacks would be emancipated. Outside the party system were abolitionists like William Lloyd Garrison and Wendell Phillips, who were so outraged by slavery that they called for its immediate abolition or, if that didn't occur, the separation of the North from the South.

Faced with this welter of attitudes, Foner shows, Lincoln steered a middle course. He believed slavery violated America's basic principles — a view he expressed forcefully and frequently. Still, he was reluctant to take dramatic action against it, unlike some of the radicals within the Whig Party. He remained so devoted to the American Constitution, with its protections of slavery, that he supported (albeit with reluctance) the Fugitive Slave Act of 1850, which imposed stiff penalties on Northerners who assisted runaway slaves. At the same time, he never faltered in his effort to prevent slavery's western expansion, and he refused to follow party conservatives who were overly conciliatory to the South. When the Republican Party formed in the 1850s, Foner explains, it was Lincoln's middling position that made him the North's most attractive presidential candidate in 1860 and helped him keep his wits about him during the tumultuous war years. So dexterously did he navigate the political waters that he could rightly claim credit for bringing about slavery's abolition.

While appreciatively discussing Lincoln's moderation, Foner takes an unblinking look at the blots on his record: a court case during his lawyer years when he defended a Southerner trying to repossess a slave family that had claimed its freedom in Illinois; his early opposition to political rights for blacks; his stubborn belief in the need to deport American blacks, even after the scheme had become untenable; his statement that he conducted the war to preserve the Union, regardless of whether slavery survived; and an astonishing remark he once made that held blacks responsible for bringing on the Civil War because of their presence in America.

Foner adeptly contextualizes these unsavory aspects of Lincoln's history. He points out that only a handful of whites in that era espoused racial attitudes that today would be considered consistently progressive. Racism was rampant, and Lincoln reflected it. Above all, he treasured the American Union. And though he venerated the law, he was willing to use his powers as a wartime president to supersede the law, as when he suspended habeas corpus as part of his effort to crush the Southern rebellion.

Lincoln also exhibited a remarkable ability to alter his attitudes according to circumstance. At first dismissive of the abilities of black people, he came to sincerely admire them during the Civil War and eventually made strides toward endorsing political rights for them. Once staunchly opposed to the immediate abolition of slavery, he was the first president who took action in the cause of emancipation and in time, of course, he dedicated the war effort to the goal of freedom.

Lincoln once declared that he couldn't control events; they controlled him. More cogently than any previous historian, Foner examines the political events that shaped Lincoln and ultimately brought out his true greatness.

David S. Reynolds, a distinguished professor at the CUNY Graduate Center, is the author of "Walt Whitman's America," "John Brown, Abolitionist" and "Waking Giant: America in the Age of Jackson."

http://www.nytimes.com/2010/10/03/books/review/Reynolds-t.html?ref=books

Paris Rediscovers Monet's Magic at Grand Palais
By MICHAEL KIMMELMAN
PARIS — Poor Claude Monet.

Like white noise, he's everywhere and invisible, the staple of countless dentists' offices. Old hat for more than a century now. Is it too late to recapture some of the shock and thrill that caused horrified Parisians in the 1870s to perceive his work as "leprous"?

Amazingly, no, it's not. The Monet show that just opened here at the Grand Palais is a start. The biggest art spectacle in Europe this fall, with some 160 paintings, it is, believe it or not, the first full-dress overview Paris has staged in decades, the first chance anywhere to see the whole sweep of his work in some time. The French are treating it like a national celebration. President Nicolas Sarkozy contributed a note to the catalog extolling this "unmistakable emblem of the international influence of French culture." The exhibition would have been a box office smash even if it had corralled fewer of Monet's benchmarks.

It happens to be ravishing.

Monet the populist decorator of candle-in-Chianti-bottle bistros and college dormitories is modernism's prettiest painter, a virtuoso of picturesque country scenes and ephemeral weather but not an especially heavyweight thinker or troublemaker. Clichés about him as a wandering minstrel in a white beard trailed like the Pied Piper by children toting his canvases across hill and dale haven't exactly toughened his reputation, either.

This show, surveying his long career and probing its depths, helps restore something of his original status. He comes across as more than the familiar Impressionist — he comes across as a painter of strange and elusive probity, of memory and reflection, as an artist seeking not just to simulate sun, rain and snow, but states of

mind as well. He gave form to "the heavenly pasturage our minds can find in things," is how Proust once put it.

In part he did this by returning again and again, as the exhibition stresses, to certain sites and motifs, completing pictures not on the spot, but often in his studio, based on what he remembered.

All this is hardly news, and to make the case, pictures in the show are hung, albeit a bit confusingly, by subject as opposed to chronologically, with occasional pedestrian ones from haunts like Vétheuil and Antibes. Monet became a very rich man churning out 2,000 works, and one need only hop the Métro to the Musée Marmottan Monet to see, among some great paintings, plenty of absolute stinkers.

That said, it would be churlish to belabor the exhibition's failings. Intelligence and sobriety befit an artist too glibly thought of as easy. In the flesh, his best works, it turns out, thwart the problem of their own endless reproduction by being, well, irreproducible. You just can't grasp the bejeweled, darkling purple and pink light emanating from the moody reveries of Venice he painted well on in his career except by standing before them. They're views steeped in Whistler, Turner and a kind of exquisite sadness. Only planted in front of "Bathers at La Grenouillère" can you properly get the squinting effect of slanting sun splashing off rippled water, ripe with summer dreams and visual puns, that blurs the silhouettes of figures in the middle distance.

His path was never straight from material realism toward greater abstraction. Conditions dictated style. Steam rising through the gloom at the Gare St-Lazare called for gossamer curlicues of pink and white on smeared patches of gray-blue pigment one day. The next, a sharp spring sun across the Quai du Louvre demanded more crystalline clarity.

And before the awesome rock portal at Étretat, Monet elected dots and dashes to connote raw nature and a swift wind. The style, precisely what shocked and appalled old-school Parisians, masqueraded as an instant take on the subject. Former fishing villages on the Norman coast like Étretat were already turning into resorts catering to vacationing urbanites who wanted to experience such places as if unspoiled by people like themselves.

Indulging such self-delusions, the painter created not just spontaneous records of unblemished countryside, but also heightened versions of vistas and monuments unspoiled and so beckoning that, faced with the real thing, a natural instinct was to reconcile truth to fiction, rather than the other way around.

I mean that Monet's visions of places can come to inhabit and even supplant our direct memories of them. At Rouen, he doesn't just capture the cathedral in shifting conditions. He seizes on the way that memory, associated with a place or image, experienced at a certain time and in a certain mood, triggers bundles of emotions and lodges itself in the mind as a kernel of pleasure and pain. Classic Impressionism, as a mere meteorological affair, misses the point. Abstraction does, too.

Monet was really painting mental states, states of reflection. His late, sublime "Water Lilies" is literally that: reflections of light, clouds and foliage against the surface of his pond at Giverny, Monet's erotic, mysterious, multicolored abyss of shimmering, indefinite space, which kind of describes memory itself.

What makes these pictures look so modern has partly to do, as every art museum docent points out, with their lack of foreground and background and the obvious debt to Japan. But mostly it's to do with the aspiration to render the intangible — to make millions of material facts immaterial and unshackle them from time. Giverny was both his Eden and object lesson. There, Monet could see the daily transience of things saved from oblivion only by memory and by art.

There's a photograph he took of himself around 1905, when he was in his mid-60s. In it, he's standing on the edge of his lily pond, his head casting a shadow on the sunlit water. Lilies float above. The effect is a little disorienting. A temptation is to imagine we're looking up at Monet, so that the lilies become clouds and the pond, sky. It's akin to the "Water Lilies," where the horizon line dissolves and where it's hard to tell whether the view depicted is across the water, from above it or even from underneath. But in this case he's in the picture.

By the way, it's an interesting question, Monet and the camera. He loved new things. He followed balloonists and boat racers the way sports fans now track baseball and football scores. He became an automobile enthusiast, buying one of the first Panhard-Levassor motor cars, with leather upholstery. The occasional photo aside, why not the camera? What did it lack, besides color?

Perhaps photographs seemed to him too literal, too far from the interior states that were his real project. We can make out his beard and profile under the familiar wide-brimmed hat in his photograph. It conjures up other images we have of him as stout, natty, in tweed suit, cambric shirt and ankle boots, a human brandy snifter. His photograph, although a jeu d'esprit, exudes a whiff of melancholy because like all photographs it's a reminder, with that shadow, of something gone except in the picture and our recollections of it. Monet managed in the photograph what he exalted in paint: the effervescent pleasure of seeing and the inevitable disappearance of that pleasure.

No wonder Proust revered him. Proust also wrote that his pictures "make us adore a field, a sky, a beach, a river as though these were shrines which we long to visit, shrines we lose faith in when we see." Reality, with its mess and noise, fails to live up to what Monet painted.

But Proust also meant that Monet didn't just idealize places; he wasn't just a French weatherman with paints. He showed us Argenteuil and Belle-Île, the Houses of Parliament in London and the banks of the Seine, vibrating with electric color, "parts of the world," as Proust said, "that are themselves and nothing but themselves," places that already existed in our imagination, as if waiting to be discovered and that now bid for our affection.

"On the threshold of love we are bashful," Proust noted. "There has to be someone who will say to us, 'Here is what you may love: love it.' "

Monet does exactly that.

And how can we not?

http://www.nytimes.com/2010/10/05/arts/design/05monet.html?ref=design

Behind That Humble Pitchfork, a Complex Artist
By JANET MASLIN

GRANT WOOD

A Life

By R. Tripp Evans

Illustrated. 402 pages. Alfred A. Knopf. $37.50.

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The cover of R. Tripp Evans's "Grant Wood: A Life" does not depict "American Gothic," the painting for which Wood is best known. Instead it features a lush green landscape, replete with rolling hillside and curving country road. On that road is a truck colored so prettily, picturesquely red that it suggests a freshly painted barn. There is a naïve-looking simplicity to the way this image has been rendered.

Look again. This is a picture called "Death on the Ridge Road" (1935), and it is as menacing as it is sweet. The truck is on a collision course with a large black car, and a third car lurks in shadows in the painting's lower left corner. A storm brews in a corner of the sky. The fence posts beside the road tilt menacingly, while the two cross-shaped telegraph poles suggest the funereal. Wood had a special fondness for the funerary and once used a coffin lid as his studio's front door.

The whole image summarizes what this book will say: that Wood was not the simple, homespun, rustic Iowan he may have seemed to be. Jarring as it may be, this idea should not come as a surprise. Any look beyond "American Gothic," or even a close look *at* that familiar image of man, woman, house and pitchfork, will dispel the notion of Wood as a harmless, mainstream champion of patriotic Americana. So will any familiarity with the facts of his life.

Yet as recently as 2005, at a Wood exhibition in Cedar Rapids, Iowa, where he lived for many years, the catalog called Wood "the quintessential painter of America in the 20th century" and added, "Wood had a vision of the values that made this country great." "Welcome to Grant Wood Country!" says a recent brochure for travel to the Midwest.

Wood had a vision, all right. But it was far more sly, sensual and complicated than is commonly acknowledged. And even a cursory look at his gallery of work makes its stealth and subversiveness abundantly clear. What is most remarkable about the false impressions that surround Wood is that he did not guard his secrecy with any great zeal. Friends knew him to be mischievous (as evidenced by his paintings' elaborate use of symbolism), homosexual and a bit facetious in his masquerade as an overall-clad farm boy. They knew that his ultra-Iowan simplicity was more than a little contrived.

Yet blandness became his trademark once he became famous. "I'm the plainest kind of fellow you can find," he once said, with typical disingenuousness. "There isn't a single thing I've done, or experienced, that's been even the least bit exciting." When The Daily Iowan published a scientific recording of Wood's brain waves in

1936, it showed a perfectly uniform sine curve, and the chart became proof of his ordinariness. So Mr. Evans has good reason to claim that Wood has come to be both narrowly known and narrowly understood.

"Grant Wood" begins by pointing out the most obvious discrepancies between Wood's biography and his legend. Once he decided to go back home and become classically American, his bohemian days in Paris in the 1920s were expunged from his public image. So were his early interests in interior decorating and jewelry design. And so were his forays into Impressionism, which by the 1920s, Mr. Evans says, had taken on exactly the kind of feminine connotations that Wood was eager to avoid. By comparison the American Regionalism of his later work was deemed manly, red-blooded and mainstream in ways much more helpful to Wood's career.

Mr. Evans's main emphasis in this analytical biography is on the gender-related hidden meanings that can be found even in Wood's most innocent-looking work. In a book that is far stronger on art interpretation than on personal details, he finds much to study in the pictures themselves.

He looks beyond the toylike exuberance of the landscape "Stone City," for instance, to see that Wood clearly painted rolling hills that resembled supine male buttocks, and that the tidy little cornfield in the foreground presents "a seemingly endless battalion of ejaculatory corn sprouts." Do such claims sound far-fetched? The painting supports them incontrovertibly.

Wood clearly loved to hide things in plain sight. He also loved to create images that, like "American Gothic," ensure that "the viewer doesn't know whether to giggle or shiver." Mr. Evans offers intensive analysis of "American Gothic" as well as many other Wood paintings, most notably "Parson Weems' Fable" (1939), which rivals "American Gothic" for tacit but turbulent complexity and is so surpassingly strange and dreamlike that it is "a kind of Rosetta Stone to Wood's inner conflicts."

Some of Wood's images, like the dour "Return From Bohemia," with its Gothic arch-shaped barn and collection of mournful relatives gathered behind an image of Wood (their eyes are closed; his stare balefully at the viewer), are so odd they remain nearly impenetrable. And the second work that Wood called "Return From Bohemia," an incomplete memoir on which Mr. Evans also draws, does not cast much light. Wood's own voice can barely be heard, beyond one catty female acquaintance's description of it as sounding "like the fragrance of violets made audible." His words certainly don't have the impact that his work does.

Mr. Evans can be ideologue enough to dismiss another critic's notion of alluring female bodies in Wood's work as "ambient heterosexism." But he acknowledges the presence of three women in Wood's otherwise all-male universe: his sister, Nan (the model for the female figure in "American Gothic"); his mother, Hattie (whose apron and cameo turn up on Nan in that famous image); and his wife.

Wood married in 1935, but his wife, Sara Sherman Maxon, does not loom large in his story. Mr. Evans draws on Sara's unpublished papers to describe the marriage, which ended in Sara's divorce claim of having suffered "such inhuman treatment as to endanger the life of the plaintiff." As with so many of the other insights offered by this provocative book, her claims create more mystery than they dispel.

http://www.nytimes.com/2010/10/04/books/04book.html?ref=design

Sweet Home California

By PATRICIA LEIGH BROWN
SACRAMENTO

MANY people would consider State Highway 160 to be a why-bother sort of a landscape, an isolated and unremarkable byway atop a levee along the Sacramento River in which the lone landmarks include a ramshackle bait and tackle shop and rusty pipes from an old sugar beet factory.

But for the artist Wayne Thiebaud, whose paintings luxuriate in the commonplace — be it his signature bakeshop-window cakes and Boston cream pies or a roast chicken twirling on a rotisserie — the Sacramento Delta is fertile ground. Home ground.

“Aren’t the colors marvelous?” he asked one afternoon recently, as if seeing this watery Netherland-like country outside Sacramento for the first time. He will often come here with his artist friends, setting up his French painting easel along the levee. “The river changes almost constantly, from black to brown to coffee color to green to blue,” he said. An hour passed; the water shimmered silver. “It helps fortify your focus,” he observed. John Singer Sargent, he added, “was probably blessed with a photographic memory. But with me, it’s about remembrance — sketching certain types of reflected patterns, different kinds of lighting, then conjuring it up with your memory and imagination.”

Mr. Thiebaud’s imagined delta landscapes — where azure furrows meld with emerald levees, violet fields and confetti orchards and a river with phosphorescent banks flowing dizzily in several directions — are among the 75 paintings and drawings to be featured in “Homecoming,” a retrospective at the Crocker Art Museum in Sacramento, the city he has called home since the 1950s. The exhibit, on view from Oct. 10 through Nov. 28, coincides with the opening of a 125,000-square-foot wing, designed by Charles Gwathmey and Gwathmey Siegel Associates, that nearly quadruples the museum’s gallery space.

Mr. Thiebaud (pronounced TEE-bo) — who turns 90 next month — has been the subject of major retrospectives before, most notably the 2000-01 show that originated at the Fine Arts Museum in San Francisco and traveled to the Whitney Museum of American Art and elsewhere. But the Crocker holds a special place in his heart; it was here the first solo museum show of his work, "Influences on a Young Painter," was held in 1951. "I love the Crocker," he said, pausing to admire a Thomas Hill panorama of Yosemite Valley shared with generations of his art students. "I've stolen many ideas here."

Mr. Thiebaud's affection for a city many Bay Area residents regard as a blur en route to Lake Tahoe — despite its status as the state capital — is long and deep. Like the artist himself, who greets people with a friendly "Howdy," it is air-kiss-free, an unpretentious Giverny of the California interstate. It is arguably a rather odd place to find a major American artist. (The city's other international figure, Gov. Arnold Schwarzenegger, is a part-time interloper from Los Angeles.)

"It is a pretty real place," mused Mr. Thiebaud, clad as he often is in tennis whites from the doubles match he plays nearly every morning at a neighborhood tennis club, often with men half his age. "There's a sense of lineage, of families over generations," he said. "The Gold Rush and the Pony Express made Sacramento a substantial place in terms of enterprise."

Mr. Thiebaud has been able to live a civically engaged family life while forging an independent vision as novel as the bewitching rainbow-colored "halos" outlining the contours of his pies, lipsticks, paint cans, ice cream cones, cream soups, gum ball machines and other Thiebaudiana.

His personal geography infuses much of the work at the Crocker — the models for "Five Seated Figures" (1965), a formal study in isolation, for instance, include a local gallery owner, and a matriarch of the McClatchy newspaper family, as well as the artist Patrick Dullanty, a beloved friend who died in 2004. Numerous portraits spanning different periods and painterly moods depict Betty Jean Thiebaud, his wife and muse of 50 years, whom he met at a Newspaper Guild ball in Sacramento while accompanying a tennis friend who was a local reporter. ("I went with him, she was there, and that was it," he explained.)

There are also tender early drawings of his children. The Thiebauds were devastated earlier this year when their son Paul LeBaron Thiebaud, the owner of three galleries in New York, San Francisco and Sacramento, where he lived, died at 49 of a rare form of colon cancer. Theirs was an unusual bond: Paul started his career as a teenager selling his father's prints out of the back of a Volvo station wagon. "He packed several lives into one," Mr. Thiebaud said.

Mr. Thiebaud still paints twice a day, pausing for tennis and lunch at home with Betty Jean (the routine has helped, friends say). At his studio in a nondescript building downtown he mixes paints in the plastic caps of tennis-ball cans the tennis club collects for him. He also regularly has coffee with friends like the painter Fred Dalkey, "sometimes grousing," said Mr. Dalkey, but more often discussing Cézanne and other artists they admire. "Wayne is a very private person, very hard-working," he said. "I'm sure in the back of his mind he's waiting to do a great painting."

In ways large and small, Mr. Thiebaud's celebration and appreciation of the ordinary — "the flotsam and jetsam of middle-American life" as the philosopher Richard Wollheim once put it — is resonant of his home turf, the California sense of optimism. "Wayne has the character of this place in his bones," said Lial Jones, the director of the Crocker. "There's a directness about him, an ease, a humbleness."

Yet Mr. Thiebaud has never been circumscribed by his locale. Many of his most defining moments have occurred in Los Angeles and especially New York, where he spent the better part of 1956 and '57 immersed in Abstract Expressionist circles centered around the Cedar Tavern, the Eighth Street Club and the cooperative galleries along East 10th Street, becoming close friends with Elaine and Willem de Kooning.

His first artistic New York foray in 1945, however, is a rather madcap tale of holing up in a fleabag hotel with an Army buddy, each drawing cartoons and selling "to the bottom of the magazine world, to Turkey World, Shipfitter's Journal and a lot of girlie magazines that paid a dollar with names like Silk Stocking and High Heel."

"They're probably collector's items now," he said of the magazines. "Oh Lord."

In Sacramento, Mr. Thiebaud has lived apart from the competitive pressures of being "an art-industry employee," as his friend Robert Mallary once described New York. "My sin as a painter is that I just want to paint anything I want to paint — and repaint," he said.

Scott Shields, the associate director and chief curator of the Crocker, contends that while Mr. Thiebaud needed a New York moment to achieve recognition, his luminous light, arresting color and humor are Californian. "I don't think his paintings would have been at all the same if he had been from New York and stayed there," he said.

Indeed, Mr. Thiebaud has designed a specialty arts license plate for the state, a joyous ode to Southern California: palm trees, a streak of blue and a pulsating orange sunset. In his own work, beaches, alive with frolicking children and wet dogs, have long been a theme; the family still owns a condominium in Laguna Beach.

While Mr. Thiebaud was born in Arizona, much of his boyhood was spent in Long Beach, with its boardwalk hot dogs and summer visits to his California grandfather's farm.

The family often moved during the Depression; much of his early adolescence was spent on a ranch in Utah, where his family roots included a Mormon great-grandmother walking across the plains pushing a handcart with Brigham Young.

Mr. Thiebaud's original aim was to be a commercial artist, a field he deeply respects. ("I still paint as if an art director is looking over my shoulder," he said.) Over the years, he has worked a sign painter, a theatrical production designer, an art director, a poster designer, a fashion typographer and illustrator (his subjects included lipstick and shoes), a comic strip artist, a cartoonist for the Rexall Drug Company in Los Angeles and, fleetingly, as a teenage "in-betweener" at Walt Disney Studios filling in the figures of Dopey, Pluto and Jiminy Cricket.

He arrived in Sacramento in 1942 initially to train as a navigator at the Army Air Forces base at Mather Field. "I remember a bitterly cold day walking by a Quonset hut with these guys working on posters and cartoons," Mr. Thiebaud said, "and I thought, 'How the hell did those guys get that job?' "

He wound up joining them, creating a comic strip for the base newspaper. But he was reassigned to commando training after the Battle of the Bulge in 1944. On the eve of being shipped overseas, he recalled, "a guy called out my dog-tag number and said I was wanted at headquarters. The major threw down a photo of a woman and said, 'Can you make a drawing of my wife?' So I wound up staying."

Mr. Thiebaud began teaching life drawing to fellow servicemen — at one point, importing a silk-screen artist from Folsom Prison. Such gumption would serve Mr. Thiebaud well when he served as the exhibit designer for the California State Fair in the 1950s, for which he and Mr. Dullanty borrowed Picassos, Pollocks and Beckmanns from local museums and transported them in an open-air Jeep and a 1931 Dodge sedan for display in the Poultry Building — "a curatorial horror show," he admitted.

Mr. Thiebaud's role as a teacher and professor has been a pivotal one in his life — first at Sacramento Junior College (now Sacramento City College) and, most important, at the University of California at Davis, where he officially retired at age 70 but continued to teach as a professor emeritus until last year.

In a stars-are-aligned period between 1959 and 1962, a innovative art department was assembled at a small-town agricultural school, where scientists were sweating out the development of a square tomato. At Davis, art was served with a heaping tablespoon of irreverence: among the faculty were David Park, a Bay Area figurative pioneer who helped wrest subject matter from abstraction; the sculptor Manuel Neri; the painter and watercolorist William T. Wiley; the painter Roy De Forest; and the ceramicist Robert Arneson.

"It was a break-loose time," Mr. Wiley said fondly. "You were into your own resources. There was no gallery to run to."

Jock Reynolds, now the director of the Yale University Art Gallery, recalled his first day of class, when Professor Thiebaud asked his students to produce a pencil and paper. "What followed was a remarkably lucid lecture on where to buy the best and cheapest salami, cheese, coffee, fruit, bread, cakes, and wine, things he insisted would significantly enrich the quality of our lives," Mr. Reynolds said.

Later Mr. Reynolds realized that his professor was sharing more than a shopping list. "He was giving his students direct insights into the very subject matter that was inspiring his own art; the frosted cakes, cream pies, lollipops and the trays of herring and sardines he was transforming, through the skilled application of paint onto canvas, into the most tactile and sensuous visual compositions imaginable."

Mr. Thiebaud's favorite class to teach was Beginning Drawing. "You really see people transformed," he said. "Teaching it has a big fatigue factor. But once they get a sense of it, it's like heroin."

Mr. Thiebaud's own artistic passions — his teachers, if you will — populate the walls of his family's modest home on a quiet street, where the backyard is full of zinnias and the kitchen door jamb is warmly marked with children's heights. Among the many works on display are several paintings by the Italian still-life painter Giorgio Morandi, who "creates a kind of theater of repeating objects, the same object over and over again but with different dramas," Mr. Thiebaud said. In his sketchbooks, which he is rarely without, Mr. Thiebaud makes constant notes to himself, like "check & refine color level." He still makes studies of hot dogs.

He plans to return to teaching in the spring, he said, and continues to paint all the time, an act of deeply felt choreography in which "you feel the brush, the plumb line of your body, the misalignment or the joy of feeling it's right."

It is life as a bravura stroke.

http://www.nytimes.com/2010/10/03/arts/design/03wayne.html?ref=design

First Look Inside the Proposed Islamic Center
By ANNE BARNARD

Visitors to the upper floors of the Muslim community center planned for near ground zero would walk through lofty spaces — for art exhibitions, for contemplation and prayer, for programs on interreligious dialogue, for a 9/11 memorial — as sunlight streams through irregularly shaped windows between white crisscrossing beams.

That is the image presented in the tentative architectural renderings that the planners of the center, called Park51, have been showing at community meetings in recent weeks, and which were revealed to the wider public for the first time last week.

A sketch of the façade shows a latticework of white starlike designs, echoing patterns that can be seen in Islamic architecture and decorative tiles across the Middle East.

The design was meant to show "hints of tradition," while the use of modern materials and glass panels would give an impression of translucence and "moving toward the future," Sharif el-Gamal, the project's developer, said in an interview last week.

The planners have not begun to raise the $140 million needed for construction or hired an architect.

An image of the façade has been in circulation since early this year, but last week the planners revealed renderings of how some interior spaces might look and how the center's many amenities — including a restaurant, theater, day care center, gym and pool — might be stacked in a building of up to 15 stories.

There would also be a 9/11 memorial and a space open to people of "all faiths and of no faith" for prayer, contemplation and meditation, Mr. Gamal said.

The space for Muslims would be in the basement. Technically, it would be a prayer hall known as a musalla, because its construction would not meet rules required to sanctify a mosque.

Muslims who worship in a musalla often refer to it as a mosque or masjid. Some opponents say it is inappropriate to have a mosque near ground zero

http://www.nytimes.com/2010/10/03/nyregion/03muslim.html?ref=design

Things Are Happening in Hamra

By SETH SHERWOOD

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BEIRUT — Take one of Beirut's battered 1970s Mercedes taxis through the city center and you'll chance across plenty of gold-plated names these days.

Here, splayed across one of the plywood walls that surround proliferating construction sites is the logo for Norman Foster's architectural firm, announcing a trio of residential towers. There, on a billboard down the street from the glitzy Buddha Bar is the signature bald head of the French architect Jean Nouvel, who's creating a complex called, modestly, The Landmark.

Thanks to a couple of years of relative stability, this Middle Eastern capital is building like the Pharaohs. But the boom has come at a cost. Older buildings, full of wonderful Arabian details, have been demolished. People on five-figure incomes have been priced out.

Fortunately, there is an antidote. When the personality of the city starts to feel stifled by steel and glass, I often catch a taxi and tell the driver the one word that embodies all that is most dynamic, inspiring and authentic about Beirut: Hamra.

Long the center of intellectual life and leftist politics before the 1975-1990 civil war, this neighborhood of venerable six-story apartment buildings, leafy university campuses and teeming street life has been undergoing a renaissance of its own. A spate of new book-lined Wi-Fi cafes, contemporary art spaces, cozy bars, and eclectic music clubs are helping re-establish Hamra as the city's most progressive, happening corner.

All along the diverse main drag, Hamra Street, fully black veiled Shiite Muslim matrons drift past dolled-up, miniskirted Christian women, and purveyors of Koranic literature share the pavement with slick bookshops selling French-language interior design tomes.

To find some of Hamra's more interesting characters, you might begin by visiting the two-year-old Galerie Tanit, which has joined the older Agial Art Gallery in raising the profile of Hamra as a contemporary art center.

On an August afternoon the walls were decorated with several of large collages by Zena el-Khalil, a 34-year-old author and top Lebanese artist who has lived next to Hamra for years and rhapsodized about the neighborhood in a memoir, "Beirut, I Love You."

In Ms. Khalil's art, cut-outs of Lebanese, Syrian and Israeli characters and icons have been feminized with loads of glitter, fake flowers and rainbows. Plastic pistols have been covered in girly pink paint. But the superficial silliness of the works belie Ms. Khalil's intelligence and compassion.

"I take objects of violence and aggression and über-masculinity and I kind of take them in and spit them out into my world, which is filled with love and beauty and peace," Ms. Khalil said. "Death is a few steps away. And so I think that you develop a kind of humor or irony when you live in a situation like this, and it helps you get through life."

Ms. Khalil offered a quick tip upon parting: Try some of Hamra's new generation of cafes. For the Birkenstock brigades, the hangout of choice is Bread Republic, a two-year-old bakery and cafe that hosts a small outdoor farmer's market on Tuesdays. For the creative set, the new hub is T-Marbouta. Like a java-junkie speakeasy, the space is hidden away on the second level of a humdrum shopping mall (the Pavilion Center) in a ramshackle side street primarily frequented by old Lebanese women eager to snap up cheap plastic shoes.

Within the dark cafe, Gauloises cigarette smoke drifted among the paintings by local artists, exhaled by bespectacled grad students and media types who tap the keys on their MacBooks. The music of Fairouz, the great Lebanese diva, filtered quietly from the sound system.

"From the beginning, T-Marbouta has sought to be politically and socially engaged," read the manifesto on the menu, in English. "An open cultural space where all could come to socialize, read, meet, surf the net, and discuss issues of the day."

Hala Alsalman, a 32-year-old Canadian-Iraqi documentary filmmaker, sat on a vintage couch next to the cafe's separate library, which has film screenings on Monday nights and offers an impressive buffet of books, CDs and DVDs.

She was in Beirut to document the rebuilding of the old, destroyed synagogue in downtown Beirut as part of a film project about Jews in the Middle East. Beirut's Jewish community has dwindled to fewer than 100 people, she said, but the synagogue project has nonetheless won partial funding from Solidaire — the development corporation in charge of rebuilding much of Beirut's downtown — and the green light from Hezbollah, the Shiite Muslim militant organization and political party.

"It's a pretty amazing place," she said, opening her laptop to reveal a large photo of the building's grandly vaulted interior and Arabian architectural details. "Many Lebanese don't even know it's there."

But the spirit of 21st-century Hamra emerges most fully as the sun sets and the lights of its many D.J. bars and live music spots flicker to life. That spirit echoes from every corner of the neighborhood, from the animated conversations in the livingroom-like Ferdinand lounge, noted for its hamburger with blueberry jam, to the live jazz and Arabian pop echoing from sleek new music bars like Cello and Mojo's.

On a Tuesday night, a three-piece combo called Pindoll filled the small basement stage at a bar called Dany's. The group shifted between cool swing, oddball funk and a lounge jazz version of "These Boots Were Made For Walkin"' as a packed crowd swilled bottles of Almaza Beer.

Upstairs on the outdoor terrace, the owner Dany Khoury, a 33-year-old art director for films, marveled at the boom in local nightlife since he opened his namesake watering hole two years ago.

"There was nothing here," he said between sips. "Now there's around 20 bars" in Hamra, including three new arrivals in the same small passageway.

The most notable is Carafe. Some nights you might cross paths with Steffi Peichal, a German-Iraqi graffiti artist who painted the shadowy human silhouettes that form the bar's wall mural. On Wednesdays the bar resounds with vintage American jazz spun by a bearded 29-year-old Lebanese D.J. called Honeydrippin' Bill. The drinkers are a combination of foreigners and locals drawn from most of the city's diverse faiths.

"Hamra was never affected by religion or politics," said Mr. Khoury, who grew up in a Christian district across town but never dreamed of opening his bar anywhere but Hamra. "You'll see neighbors who are Christian, Sunni, Shiite, Orthodox, Maronite, Catholic, Druze, whatever. They're all walking on the same streets, doing the same stuff, eating the same food."

It's an admiration often expressed among Hamra residents and habitués. As the bar prepared to close, some boisterous Lebanese customers filed out in a flurry of chatter in Arabic, English and French. Mr. Khoury smiled. "It's probably the most cosmopolitan neighborhood in the Middle East."

http://www.nytimes.com/2010/10/02/arts/02iht-scbeirut.html?ref=design

The Spirit of Xanadu, Morphing Across Borders

By HOLLAND COTTER

Art history is not a jigsaw puzzle waiting to be assembled. It's more like a smashed sheet of reflective glass, continually reshattering, with splinters scattered here and there, many lost forever. With luck and work, scholars retrieve a few splinters, put them in a guessed-at order and turn on some lights. The result is an exhibition.

If the pieces are bright and the scholarship sharp, the show can be a subtle stunner, as is the case with "The World of Khubilai Khan: Chinese Art in the Yuan Dynasty," the latest in the Metropolitan Museum of Art's line of benchmark Chinese exhibitions. This one encompasses some 300 objects, from filigreed hairpins to a couple of megaton sculptures, most of them hard-won loans from China.

In its overachieving fashion, the Met is simultaneously presenting a second, substantial show, "The Yuan Revolution: Art and Dynastic Change," drawn from its own deep holdings. Not content with serving up mere masterpiece displays, the museum has shaped both exhibitions around a specific subject: the Mongol occupation of China, from 1271 to 1368.

Although China was always ethnically mixed, it had never been subject to outside rule before the Mongol armies came pounding down from the north, driving the existing Song dynasty into exile. In 1271, the leader of the charge, Khubilai Khan, grandson of the dreaded Genghis Khan, declared himself emperor of China and head of a new dynasty called the Yuan, meaning "the beginning."

Khubilai was an ambitiously sophisticated man. He was conversant with Chinese culture, at least up to a point. (He never learned to read the language.) Formally a Buddhist, he was interested in a range of religions. He liked to build big things, and did: a fabulous city in Inner Mongolia called Shangdu, known in the West as Xanadu, and, on the site of present-day Beijing, an imperial capital called Dadu that became an international showcase.

Still, to his dying day he was Mongol through and through, though one with cosmopolitan seasoning. He liked sleeping in the tents favored by his nomadic ancestors, particularly if they were erected within the palace gardens.

The Mongol invasion was, inevitably, traumatic, causing social and economic upheaval in every area, including art. The invaders were respectful of Chinese high art, with its fabled refinements, and undoubtedly

hoped that association with it would make their governance more acceptable to their new subjects. At the same time, they retained elements of their own more flamboyant aesthetic, and it is the intertwining of these two strands, Chinese and Central Asian, that "The World of Khubilai Khan" explores in thematic sections devoted to daily life, religion, painting and sculpture, and decorative arts. (The show was organized by James C. Y. Watt, chairman of the Met's Asian art department.)

You get a vivid hit of Mongol style right at the start, in a much-reproduced painted portrait of Chabi, Khubilai's moon-faced favorite consort, who appears in a bold red cap topped by a funnel-shaped column from which emerge feathers and pearls. Such hats were called gugus. One visitor to the Yuan court mistook a cluster of women wearing them for a battalion of soldiers with lances.

The show's first section, "Daily Life," delivers even more flash (and a strictly aristocratic perspective) with its jumble of high-end objects: jade belt hooks, embroidered slippers, bronze vessels, porcelain jars and gold items. The Mongols loved gold everything: jewelry, dishware, saddle plating. Guests at imperial functions were expected to wear cloth-of-gold outfits, preferably sewn with gems. The massed effect, seen by torchlight or in full sunlight, must have been blinding, and utterly un-Chinese.

The Mongols were no less declamatory in their architecture: they borrowed Chinese structural designs, then piled on ornament. A glazed pottery dragon's head in the show was created as a roof fixture for a stolid and still standing Yuan Taoist temple, the Yonglegong, in Shanxi Province. Technically, the sculpture was mainly an embellishment. But standing five feet high, painted flame orange and sea-green, and snarling like a ravenous Muppet, it must have commanded all eyes.

Moving from outsized to miniature, displayed in the same gallery is an exquisite porcelain headrest with a surprise tucked away in its hollow base: a tiny theater with gallery actors performing the roles of Taoist immortals having a birthday party. Given the Mongol flair for visual histrionics, it is no surprise to learn than the Yuan era was a golden age for theater, with Dadu a 14th-century Broadway and Off Broadway rolled into one. The city had hundreds of performance spaces, indoors and open air, offering a full menu of theatrical genres from fantasy epics to topical farces and song-and-dance vaudevilles, the forerunners of Chinese opera and kung fu films.

The variety of religions was also wide, wider than it would ever be in China again. Chan Buddhism — Zen, in Japan — was just of one of several popular sects when the Mongols arrived with their own Himalayan version of the faith. And the sections of the show devoted to religion are particularly fascinating for their demonstration of how spiritual and aesthetic currents intersect.

The face on a marvelous 14th-century wood carving of an arhat, or luohan, a companion of the historical Buddha, is classically Chinese, while the body bends and twists in ways associated with Indo-Himalayan sculpture. And a painting of two very-Chinese-looking arhats floating in a very-Chinese-looking landscape is inscribed in Tibetan on one side and Newari on the other, leaving its place of origin — Tibet, maybe? — up in the air.

Having taken a Tibetan Buddhist deity as his personal savior, Khubilai Khan was somewhat resistant to Taoism. As a result, little art related to that Chinese indigenous nature religion survives from the Yuan, though what does remain includes some intriguing hybrids.

In a scroll depicting the meeting of two Taoist immortals, one wears the conventional uniform of a scholar; the other is loosely robed, dark-skinned, with a unkempt beard, all of which signaled "barbarian" in Chinese art. And this immortal has one other really distinctive outsider feature: brilliant, laser-beam blue eyes, of a kind found on portraits of monks in Central Asia. There's a very similar image in a mural at the Yonglegong temple, proof that even in the most Chinese of contexts, the Mongol spirit found a place.

But Yuan culture turns out to be a crazy-quilt of such meetings, and the exhibition, in accounting for them, begins to feel like a succession of random spiritual flickers, with a bit of Hindu-style sculpture followed by a flash of Islamic calligraphy, then a Christian cross or two. One astonishingly code-jammed hanging scroll depicts Jesus in the guise of a Manichean prophet sitting on a Buddhist lotus throne.

And then there's a whole other kind if art, a radical style of painting that was the dynasty's single greatest, if somewhat accidental, aesthetic innovation.

After assuming imperial power Khubilai discontinued the Chinese system of state examinations through which scholars had traditionally gained court and civil appointments. By ending the exams — which they, of course, could not have passed — the Mongols effectively disenfranchised an entire intellectual class.

That class included artists, some of whom responded by creating a kind of anti-establishment painting: private, self-expressive and semi-abstract, closely related to writing, and conceived on an intimate scale. For many, this was a form of protest art, one that would have tremendous influence in the centuries ahead. The second Met show, "The Yuan Revolution," takes the full measure of this art.

Interestingly, the style was more or less invented by a descendant of the Song imperial family, the polymath painter and calligrapher Zhao Mengfu (1254-1322), who scandalized his peers by accepting a government job from Khubilai.

Maybe Zhao thought he could use his position in court for the greater benefit of Chinese art. Maybe he just wanted a settled environment in which to produce his own work. Whatever, produce he did, turning out the naturalistic paintings of horses for which he was renowned, along with copies of revered images from the distant past and calligraphic landscapes that looked to future.

In the hands of certain contemporaries, like the scholar-painter Ni Zan (1306-74), they also looked at the present. In a personal boycott of the Mongol regime, with its prejudicial attitude toward many native-born Chinese scholars, Ni took to living a fugitive's life on houseboat, always on the move, painting soundless little vistas of river and sky, with thin bare trees standing as symbols of his own rectitudinous isolation.

"The Yuan Revolution," organized by the Met curator Maxwell K. Hearn, has four Ni paintings. And two more take pride of place in "The World of Khubilai Khan," which concludes, as it began, with a gathering of fragments: namely, swatches of fabric — cloth of gold, satin damask, tapestry — cut or torn from long-vanished larger textiles and carrying mingled fragrances of China, India, Nepal, Tibet, Turkey and present-day Iran.

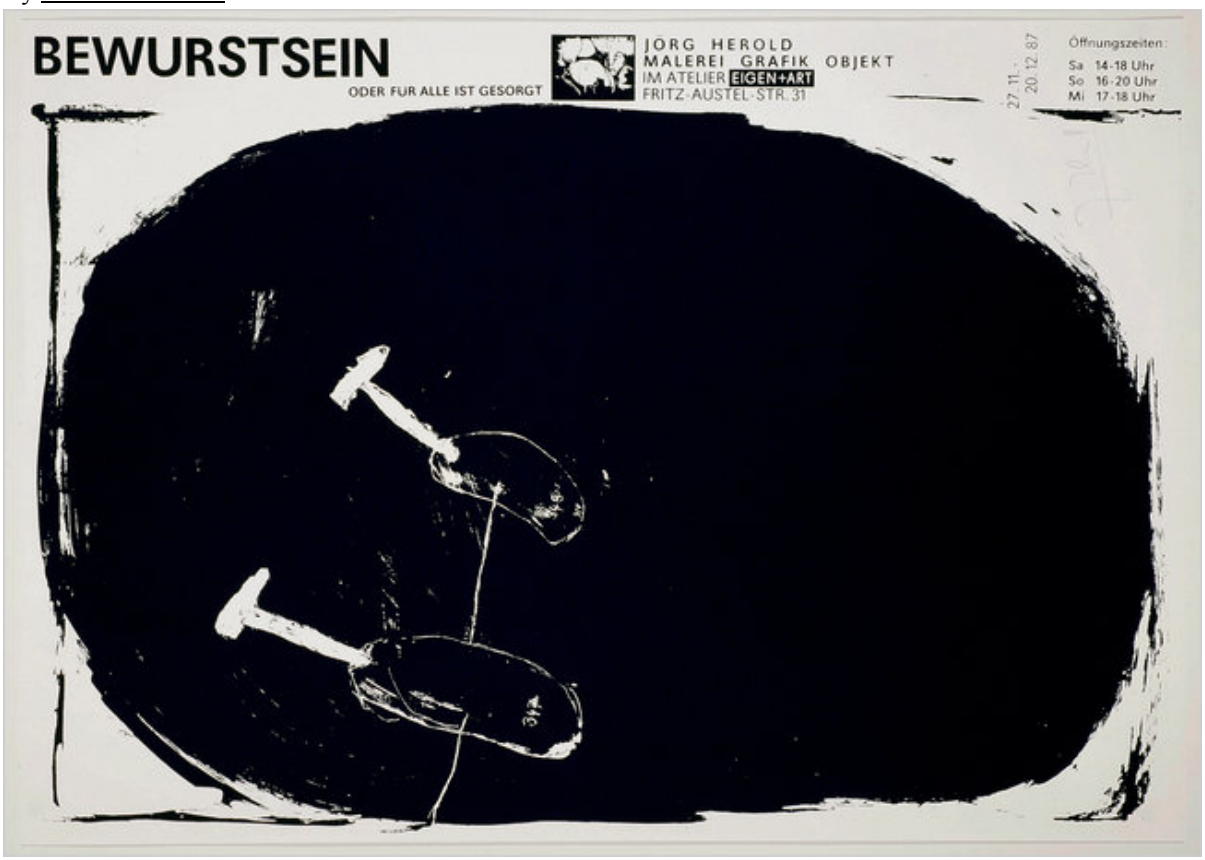
Really, the entire loan exhibition is composed of patches, odds and ends: funny old hats, bits of buildings, mixed-up paintings, ambiguous personalities. Its subject is a dynasty that neither fully transformed the culture that it conquered nor was fully transformed by it, and in the end comes across, despite high moments, as indistinct, an image with no center, like a reflection in shivered glass. How do you make a show that catches history as it really is, a process of perpetual breakage and dispersal? This show is one way to do it.

"The World of Khubilai Khan: Chinese Art in the Yuan Dynasty" runs through Jan. 2 and "The Yuan Revolution: Art and Dynastic Change" runs through Jan. 9, both at the Metropolitan Museum of Art; (212) 535-7710, metmuseum.org.

http://www.nytimes.com/2010/10/01/arts/design/01khan.html?ref=design

In Printing Posters, East Germans Escaped the Censors

By KEN JOHNSON



If you could be magically transported to a time and a place that were a Valhalla for art and artists, East Germany before the Wall fell probably would not be your first choice. Thought police discouraged non-Socialist Realist painting as too bourgeois and elitist. Modernist abstraction was considered decadent, to say nothing of the sorts of avant-garde styles prevailing in the capitalist West. Artists who veered from the party line put themselves at great risk.

There was a bohemian underground. Artists created nonapproved sorts of work in the privacy of their studios and produced exhibitions and theatrical events under the radar of official surveillance. But there is a reason that it is hard to think of an artist who thrived in the East while the stars of West Germany, like Joseph Beuys and Anselm Kiefer, rose to stratospheric heights. A little repression might be good for artists, giving them something to butt up against. But a lot is crushing. The most successful of all the East German artists, Georg Baselitz, Gerhard Richter and Sigmar Polke, moved to the West as young men in the ’60s.

What the authorities did encourage — or did less to discourage — were printmaking and other forms of graphic communication that, in theory at least, could be more broadly accessible to, and edifying for, the masses. Posters were accepted forms of expression, and artists who produced them in limited editions, not only as advertisements but also as works of art in their own rights, enjoyed relative freedom from censorship.

Which brings us to “Künstlerplakate: Artists’ Posters From East Germany, 1967-1990,” a selection of 120 posters, in styles that were not officially approved, promoting art exhibitions, print fairs and related events.

Drawn from the collection of the Kunstsammlungen Chemnitz, a complex of four art museums in Saxony, and featuring mostly works from the ’80s, the show, at Grey Art Gallery at New York University, is a gold mine of information about the prelapsarian East German art world, as it gives names, locations and dates of many different events. The posters — lithographs, silk-screens and etchings that eschewed Socialist Realism in favor of more personal styles and imagery —were created mainly in three centers: Dresden, Leipzig and Chemnitz.

The show tracks an evolution of style from the ’60s and ’70s, when dissident artists in East Germany modeled their efforts on works by Picasso, Léger, Giacometti and other early-20th-century innovators, to the ’80s, when artists were able to keep abreast of contemporary Western developments by studying art magazines and other publications that the state had previously withheld from circulation.

But visually, it is not a very rousing show, and not only because color takes a back seat to black-and-white design. You might imagine that products of artistic resistance to the party line would be exciting; all that pent-up creativity, rage, hope and despair should yield visions of lively cultural and political insurrection that Westerners who take their freedoms for granted would find instructive if not inspirational.

But for understandable reasons, there is little here that makes immediately vivid the lives and convictions of artists under the totalitarian boot. Most posters involve some sort of generic Expressionism — figurative or abstract, and often including hand-scrawled text — that might just as well have been produced in West Germany in the ’80s. Familiar cartoonish and primitivistic styles also abound.

Many of the posters assert emotional urgency through gestural spontaneity, but they do so in such generalized ways that it remains unclear to what end. In a brochure essay, Robert Brennan, a graduate student at New York University’s Institute of Fine Arts, astutely notes, “For the most part, oppositional content, when it appears in the exhibition, is subtle and indeterminate.”

One piece that is more specific — slyly so — is Jörg Herold’s “Bewurstsein or Everyone Will Be Taken Care Of” (1987), a poster for an exhibition in which he installed sausage-making machinery in a gallery. The poster image is a big, flat, black blob filling most of the picture rectangle, with a pair of little hammers with sausage-shaped handles crudely scratched into it. Presumably this refers to Communism’s leveling effect on the human spirit. Bewurstsein, which contains the word for sausage, plays on bewusstsein, the word for consciousness.

Because so much is in the Expressionist vein, exceptions are that much more compelling. Baldwin Zettl’s finely etched and expertly drawn 1980 image of a man and a woman basking nude in a cramped, wood-paneled sauna pays homage to printmakers of the Northern Renaissance. Its contemporary subtext is in the house of cards that the man is building on the floor, an allegory of the German Democratic Republic’s fundamentally insecure state, the gallery wall label notes.

With the influence of Western Pop Art otherwise barely discernible, Holger Fickelscherer’s precisely drawn comic image of an antique locomotive pulling a coal car full of Mickey Mouses stands out. Realized in the bold red, black and white of vintage Communist propaganda, it pictures a worker preparing to shovel Disney’s pop-eyed varmints into the combustion chamber. Black smoke belching from the engine’s smokestack has the words “Lustig Lustig” — or, “Merrily, Merrily” — spelled over it in big red letters. Made in 1989, a year before German unification, it cheerfully anticipates conversion to capitalist sources of energy.

A rare instance of aggressive sexuality is Hubertus Giebe’s 1985 poster featuring a full-frontal image of a nude standing woman drawn with a fine, anatomically specific black line, like that of early David Hockney drawings. She stands hunched over and with a glowering expression against a background of zigzagging pink-and-white stripes; drips of red ink are splattered over the whole composition. While harking back to Egon

Schiele's visceral eroticism, it has a contemporary punkish bravado. There are other nudes in the exhibition, but most if not all the others resemble academic, life-drawing class work.

When you consider that these posters were made for public consumption, it is easy to understand their relative caution, even in the '80s, when censorship was easing. What were artists doing behind the scenes, unobserved by the government's pan-optical eye? That would be worth learning more about.

"Künstlerplakate: Artists' Posters From East Germany, 1967-1990" is on view through Dec. 4 at Grey Art Gallery at New York University, 100 Washington Square East; (212) 998-6780, nyu.edu/greyart.

http://www.nytimes.com/2010/10/01/arts/design/01posters.html?ref=design