Infoteca's E-Journal

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CONTENTS

Springer
science+business media

Walk places, meet people, and build social capital

Springer Science+Business Media

Study shows that living in a walkable neighborhood enhances an individual's quality of life

People who live in walkable communities are more civically involved and have greater levels of trust than those who live in less walkable neighborhoods. And this increase in so-called 'social capital' is associated with higher quality of life, according to Shannon Rogers and her team from the University of New Hampshire in the US. Their research, looking at the social benefits of walkability in communities, is published online in Springer's journal *Applied Research in Quality of Life.*

A walkable community provides residents with easy access to post offices, town parks and playgrounds, coffee shops, restaurants, barbershops and club meeting venues. The ability to walk to these important locations in one's home neighborhood has been linked to a higher quality of life.

Social capital, a measure of an individual's or group's networks, personal connections, and community involvement, brings benefits such as reduced isolation, career connections, and neighborhood safety. What Rogers and her team's work suggests is that it is these benefits – facilitated by living in a walkable community - that enhance an individual's quality of life.

For their main study, the authors selected two municipalities in the state of New Hampshire. Ten neighborhoods were chosen in each of the cities and a total of 700 residents took part in the survey. They were asked about the number of locations they could walk to in their community to assess the level of walkability, as well as their trust in the local community, participation in community activities and socializing with friends – all measures of social capital.

On the whole, the more walkable neighborhoods scored higher on every measure of social capital than the less walkable neighborhoods. The authors found that individuals in more walkable neighborhoods tended to have higher levels of trust and community involvement, whether that was working on a community project, attending a club meeting, volunteering, or simply entertaining friends at home. Residents in the more walkable neighborhoods also reported being in good health and happy more often than those in the less walkable neighborhoods.

The authors conclude: "Walkability has been linked to quality of life in other studies. Walkability may also enhance social capital by providing the means and locations for individuals to connect, share information, and interact with those that they might not otherwise meet. The links we found between walkability and measures of social capital in this study provide further evidence for the consideration of social capital as a key component of quality of life."

http://www.alphagalileo.org/ViewItem.aspx?ItemId=91649&CultureCode=en

Scientists map what factors influence the news agenda across the EU

Bristol, University of

Computer scientists have analysed over a million news articles in 22 languages to pinpoint what factors, such as the Eurovision song contest, influence and shape the news agenda in 27 EU countries. This is the first large-scale content-analysis of cross-linguistic text using artificial intelligence techniques.

Every day hundreds of news outlets across Europe choose which story to cover from a wide and diverse selection. While each outlet may be making these choices based on individual criteria, clear patterns emerge when all these choices are studied over a large set of outlets and a long time.

The international team of researchers is led by Nello Cristianini, Professor of Artificial Intelligence at the University of Bristol in conjunction with Professor Justin Lewis, Head of the School of Journalism, Media and Cultural Studies at Cardiff University. An article published in the issue of *PLoS* ONE (Dec. 2010), has discovered that the news content chosen reflects national biases, as well as cultural, economic and geographic links between countries. For example outlets from countries that trade a lot with each other and are in the Eurozone are more likely to cover the same stories, as are countries that vote for each other in the Eurovision song contest.

Deviation from "normal content" is more pronounced in outlets of countries that do not share the Euro, or have joined the EU later. The analysis the researchers have conducted could not have been done in the past, due to the sheer scale of the data, but is now possible using automated methods from artificial intelligence because of recent advances in machine translation and text analysis.

Professor Nello Cristianini from the University's Intelligent Systems Laboratory in the Faculty of Engineering said: "Automating the analysis of news content could have significant applications, due to the central role played by the news media in providing the information that people use to make sense of the world."

The researchers selected the top-ten news outlets, established by the volume of web traffic, for each of the 27 EU countries using the leading news feed of each or the main page of the news outlet. In total they gathered 1,370,874 news items from the top stories of the top outlets of each EU country for six months, from 1 August 2009 until 31 January 2010. The non-English language news items, 1.2 million, were translated automatically to English.

Several expected connections between countries were found such as Greece-Cyprus; Czech Republic-Slovakia; Latvia-Estonia; United Kingdom-Ireland; Belgium-France. Links between countries not explained by borders, trade or cultural relations, could be due to other factors and could be the basis of further research.

Professor Justin Lewis said: "This approach has the potential to revolutionise the way we understand our media and information systems. It opens up the possibility of analysing the mediasphere on a global scale, using huge samples that traditional analytical techniques simply couldn't countenance. It also allows us to use automated means to identify clusters and patterns of content, allowing us to reach a new level of objectivity in our analysis."

While this approach lacks qualitative analysis provided by people, this new research is a significant breakthrough in the study of media content especially due to the recent availability of millions of books and news articles in digital format.

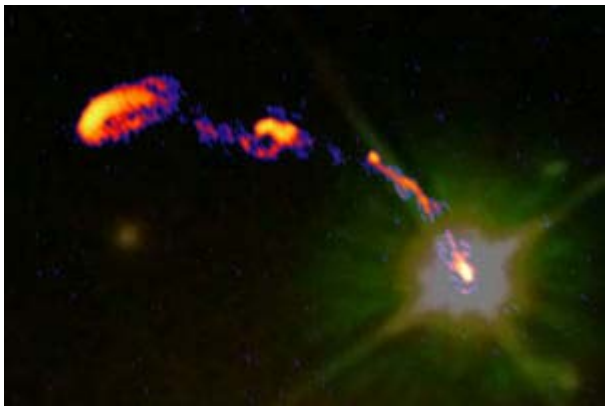
The research was carried out by an international team of scientists from the University of Bristol (UK), the Joint Research Centre (IPSC) European Commission (Italy) and the School of Journalism, Media and Cultural Studies at Cardiff University (UK). More information about the project can be found on the EU Mediasphere website at: http://mediapatterns.enm.bris.ac.uk

http://mediapatterns.enm.bris.ac.uk

http://www.alphagalileo.org/ViewItem.aspx?ItemId=91628&CultureCode=en

Black holes and warped space: New UK telescope shows off first

Manchester, The University of



This dramatic image is the first to be produced by e-MERLIN, a powerful new array of radio telescopes linked across the UK.

Spearheaded by the University of Manchester's Jodrell Bank Observatory and funded by the Science and Technology Facilities Council, the e-MERLIN telescope will allow astronomers to address key questions relating to the origin and evolution of galaxies, stars and planets.

To demonstrate its capabilities, University of Manchester astronomers turned the new telescope array toward the "Double Quasar". This enigmatic object, first discovered by Jodrell Bank, is a famous example of Einstein's theory of gravity in action.

The new image shows how the light from a quasar billions of light years away is bent around a foreground galaxy by the curvature of space. This light has been travelling for 9 billion years before it reached the Earth. The quasar is a galaxy powered by a super-massive black hole, leading to the ejection of jets of matter moving at almost the speed of light – one of which can be seen arcing to the left in this new e-MERLIN image.

The warping of space results in a 'gravitational lens' producing multiple images of the same quasar – the two brightest of these lensed images can be seen here as two bright objects, one below the other. The foreground galaxy whose mass is responsible for the lensing effect is also visible just above the lower quasar image. The radio emission seen in the e-MERLIN image suggests that this galaxy also harbours a black hole, albeit somewhat smaller.

The UK's national facility for radio astronomy, e-MERLIN is now set to produce increasingly-detailed radio images of stars and galaxies using seven telescopes spread up to 220 km apart across the UK and working as one. This combination of widely-spread telescopes provides astronomers with a powerful 'zoom lens' with which they can study the fine details of astronomical events out towards the edge of the observable universe.

The radio signals collected by the telescopes are brought back to Jodrell Bank using a new optical fibre network. These fibre links and advanced electronic receivers will allow astronomers to collect far more data and so see in a single day what would have previously taken them more than a year of observations.

In parallel with this successful demonstration of the new telescope system, work has begun on 'early science' observations intended to rigorously test its capabilities. The project has attracted astronomers from over 100 institutes across the world who will use e-MERLIN to study a huge range of astrophysics. This includes star birth and death, black holes and galaxy evolution, pulsars (the collapsed cores of exploded stars) and young planets forming around nearby stars.

The e-MERLIN project has been funded by the Science and Technology Facilities Council (STFC), the Northwest Development Agency, The University of Manchester, The University of Cambridge and Liverpool John Moores University. It is being operated by STFC and the University of Manchester.

Minister for Science and Universities, David Willetts said: "The image produced by the e-Merlin telescope is inspiring to all with an interest in the space sector.

"I am confident this impressive project will reap significant scientific rewards - it demonstrates how effective British universities are in this field."

Professor Simon Garrington, Director of e-MERLIN at the University of Manchester, says:
"This first image demonstrates the success of the complex new system of electronics and optical fibre links.

"It is also testament to the hard work put in by our engineers, scientists and technicians to turn our vision of a huge fibre-connected array of telescopes into a reality. We are very much looking forward to the new scientific results that will flow from the telescope over the coming years."

Professor John Womersley of the Science and Technology Facilities Council said: "e-Merlin is a flagship project for the UK in radio astronomy, a scientific field where the UK has a rich legacy, a strong future, and is proud to be the home of some of the very best researchers in the world.

"The project has attracted more than 300 astronomers from over 100 institutes in more than 20 countries who will use the power of this 'super telescope' to conduct major scientific legacy projects."

Professor Mike Garrett, General Director of ASTRON, the Netherlands Institute for Radio Astronomy, said:
"e-MERLIN is going to be a transformational telescope – astronomers around the world can't wait to get their hands on it.

"As a pathfinder for the next-generation international radio telescope, the Square Kilometre Array, e-MERLIN represents another giant leap forward for the global radio astronomy community."

http://www.alphagalileo.org/ViewItem.aspx?ItemId=91622&CultureCode=en

Duelling dipoles – In search of a new theory of photosynthetic energy transfer

Ludwig-Maximilians-Universitaet Muenchen (LMU)

Chemists of Ludwig-Maximilians-Universität (LMU) in Munich have refuted a basic postulate of Förster theory, which describes energy transfers between pigment molecules, such as those that underlie photosynthesis. A revised version of the theory could have an impact on the design of optical computers and improve the efficiency of solar cells.

Photosynthesis, the formation of energy-rich chemical compounds with the aid of sunlight, is fundamental to life on Earth. In plants, sunlight is collected by so-called antennal complexes, consisting of proteins bound to the green pigment chlorophyll. The chlorophyll captures the light energy and relays it, virtually without loss, via several intermediate molecules, to the reaction centers, where it is converted into stable forms of chemical energy. The intermolecular transfer process is described by Förster theory. This postulates that pigments act as oscillating dipoles to electrically excite adjacent molecules, in much the same way as the elements of a dipole antenna pick up and feed radio signals to a receiver. Measurements carried out in the laboratory of LMU chemist Professor Heinz Langhals, in collaboration with the Department of Physics at LMU Munich, have now refuted this model. “Energy transfer between dipoles depends on their orientation,” says Langhals. “When dipoles are orthogonally disposed, no energy transfer should occur. We have now tested this assumption experimentally and, to our surprise, we found that energy is rapidly and very efficiently transferred under these conditions.” In collaboration with international partners, the LMU team now wants to establish a firm experimental basis for the formulation of a new theory of energy transfer. This may well have repercussions for the development of optical computers and might help to enhance the performance of solar cells. (Journal of the American Chemical Society, 1 December 2010)

Chlorophylls and other pigment molecules, often in association with specialized proteins, can form complexes which act as efficient antennas that collect light energy and pass it on to the photosynthetic reaction centers or to the conducting layer of a solar cell. The energy is captured and transiently stored in the bonds between specific groups of atoms in the pigments, which are therefore referred to as chromophores. Different chromophores absorb light of different wavelengths, so a complex containing various types can harvest light over a large segment of the spectrum. Indeed, the original goal of the LMU researchers led by Langhals was to synthesize such a broadband light collector. The first step in designing such a complex involved the use of Förster theory to calculate the efficiency of energy transfer between dyes. This theory posits that intermolecular energy transfer occurs when oscillating dipoles – chemical compounds that carry spatially separated and opposite electric charges – cause adjacent dipoles to oscillate in their turn. Dipole orientation plays a crucial role in the process. Orthogonally oriented dipoles are assumed to be incapable of energy transfer. If molecules are oriented in parallel, energy transfer is allowed. To everyone's surprise, the measurements actually showed that energy can be transferred between orthogonally arranged chromophores with almost 100% efficiency. As Langhals emphasizes: "The process is extraordinarily efficient. This is reflected in the extremely short reaction time – 9.4 billionths of a second.

The findings rule out the idea that energy transfer occurs by a dipole-based mechanism. Instead, our results imply a low-frequency mode of coupling via intramolecular vibrations." A large-scale collaboration is now being planned to lay the experimental basis for a new version of the theory of energy transfer between dye molecules. One consequence of the new experimental data is that the so-called "molecular ruler" method may need to be recalibrated. It too is based on an aspect of Förster theory, namely the postulate that rates of energy transfer depend on the distance between the chromophores. This relationship is used to characterize biochemical binding reactions. Chromophores are attached to proteins that are suspected to bind to one another -- antibody and antigen, for example -- and the interaction is monitored by estimating the distance between them from the rate of energy transfer. The new findings will eventually lead to a new theoretical approach to the whole phenomenon, and this may have important implications for the field of photonics. Optical computers, which process information in the form of light pulses rather than electrical impulses. "This is why energy transfer plays such a central part in molecular optical computers," says Langhals. "Here the dye molecules serve as the basic elements, like the transistors in a conventional computer." Optical computers are the subject of intensive research because they have the potential to deliver extremely high processing power in very small volumes. A replacement for Förster theory could also contribute to the realization of highly efficient dye-based solar cells.

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Carbon Capture and Storage technologies could provide a new green industry for the UK

Imperial College London

The UK has the capacity to develop new green industries for capturing harmful carbon dioxide emissions from industry and storing them deep underground, but more investment is needed to further develop the relevant technologies and infrastructure, say scientists in new research published today.

The authors, from the Grantham Institute for Climate Change at Imperial College London, have published two briefing papers that highlight the potential opportunities associated with adopting Carbon Capture and Storage (CSS) technologies and the challenges involved. The researchers say developing CCS on a large scale in the UK could promote economic growth, spawning new green technology companies and services that would build and maintain the CCS infrastructure.

CCS technologies are designed to trap and transport carbon dioxide (CO) from industry, via pipelines, and store it in offshore underground reservoirs. CCS technology has been used extensively in the oil industry to recover fossil fuels from reserves and trap waste emissions in rock. However, CCS has never been used on a large scale to capture emissions from industry and power plants.

In the briefing papers, the authors say that the UK is in a unique position to develop CCS on a large scale. It has extensive oil industry expertise and a concentration of industries along the coast that are close to depleted offshore oil and gas reservoirs, which can store CO .

A large-scale CCS network could be built along the east coast of the UK, suggest the researchers. This would use a pipeline network to carry CO from industries to local storage facilities called hubs, which would pump the gas onwards to offshore to underground reservoirs.

Humberside in the north of England is one place where a CCS network could work effectively, say the authors. Humberside has several existing power stations that emit 60 mega tonnes of CO per year. A

pipeline network could pump emissions to hubs based in Humberside and on to underground reservoirs in the Southern North Sea.

However, the authors stress that there are still a number of obstacles to overcome before CCS can play a significant role in helping to mitigate climate change. More research needs to be done to improve current technologies for capturing CO so that they use less energy and are more cost effective to run. The researchers say that the UK government and industry needs to invest more money in research and development, so that rapid improvements can be made to CCS technologies.

Governments will also need to develop credible policies and regulatory frameworks, say the researchers, to assess and manage the economic, health, legal and environmental issues associated with the full-scale use of CCS.

Dr Paul Fennell, one of the briefing paper authors from the Department of Chemical Engineering and Chemical Technology at Imperial College London, says: "The transition to full scale usage of CCS is quite a challenge as we'll need to store several thousand times more CO than we do at the moment for CCS to have a significant impact on our environment. We need to design CCS systems that can cope with holding, transporting and storing these vast CO loads from our industries and power stations."

Professor Martin Blunt, briefing paper author and Head of the Department of Earth Science and Engineering at Imperial College London, says: "The UK is in a unique position to really capitalise on carbon capture and storage technology, thanks to a combination of industry expertise, the right kind of geology and concentration of industry along the coast. We could be a beacon to other countries, showing them how new industries could help mitigate the effects of climate change and generate jobs in the process. However, the UK is moving at a frustratingly slow pace. Our research shows that carbon capture and storage technologies are feasible and safe on commercial scale, however, governments and industry need to do more to ensure that CCS can play a vital role in reducing carbon emissions."

http://www.imperial.ac.uk/climatechange

http://www.alphagalileo.org/ViewItem.aspx?ItemId=91589&CultureCode=en

Bizarre Reptile Challenges Notion of Crocodiles as 'Living Fossils'

Life reconstruction of Simosuchus clarki as it may have appeared walking through the semi-arid grasslands of Madagascar in the Cretaceous Period. (Credit: Photo of type locality by Raymond Rogers; sculpture of Simosuchus by Boban Filipovic; montage by Lucille Betti-Nash)

ScienceDaily (Dec. 10, 2010) — We all know that crocodiles are reptiles with long snouts, conical teeth, strong jaws and long tails. But according to researchers at Stony Brook University in New York, we don't know what we thought we knew. Rather, some crocodiles possessed a dazzling array of adaptations that resulted in unique and sometimes bizarre anatomy, including blunt, pug-nosed snouts, pudgy bodies and short tails.

These anatomical adaptations of the incredibly diverse group of reptiles called notosuchian crocodyliforms are brilliantly illuminated in a new Memoir of the Society of Vertebrate Paleontology. This massive, richly illustrated volume, edited by Drs. David W. Krause and Nathan J. Kley of Stony Brook, clearly dispels the notion that crocodiles are static, unchanging "living fossils."

The volume, which gives an account of fossil crocodyliform anatomy, is set for publication on December 8, 2010.

The epitome of crocodyliform anomaly is represented by *Simosuchus clarki*, which lived in Madagascar at the end of the "Age of Dinosaurs" (about 66 million years ago). First described preliminarily in 2000 from a well-preserved skull and partial skeleton, *Simosuchus* shattered the crocodyliform mold with its blunt snout, leaf-shaped teeth, and short, tank-like body covered in a suit of bony armor.

" *Simosuchus* is easily the most bizarre crocodyliform ever found," declared Dr. Christopher Brochu, a leading expert on fossil crocodiles from the University of Iowa.

Over the next decade, expeditions to Madagascar recovered more skulls and skeletons, now representing nearly every bone of *Simosuchus*. A reconstruction of this uncommonly complete fossil reptile and an interpretation of its place in the crocodile evolutionary tree became the subject of the new volume.

"The completeness and preservation of the specimens demanded detailed treatment," said Krause, Distinguished Service Professor in the Department of Anatomical Sciences at Stony Brook University. "It just seemed unconscionable to not document such fantastic fossil material of this unique animal."

Brochu, who did not participate in the research, said that "very few crocodilians – even those alive today – have been subjected to this level of analysis. This reference sets a new standard for analyses of extinct crocodyliforms and is going to used for decades."

A separate chapter of the monograph is devoted to each of the major parts of the animal – skull, backbone, limbs, and armor.

"The skull and lower jaw in particular are preserved almost completely," said Kley, assistant professor in the Department of Anatomical Sciences at Stony Brook University. "This, combined with high-resolution CT scans of the most exquisitely preserved specimen, has allowed us to describe the structure of the head skeleton – both externally and internally – in exceptional detail, including even the pathways of the tiniest nerves and blood vessels."

But while it is easy to lose one-self in the details of these incredible fossils, one of the most amazing features is the overall shape of the animal. Two feet long, pudgy, with a blunt snout and the shortest tail of any known crocodyliform, *Simosuchus* was not equipped to snatch unsuspecting animal prey from the water's edge as many modern crocodiles do.

"Simosuchus lived on land, and its crouched posture and wide body probably meant it was not very agile or fast," said Joseph Sertich, a Ph.D. student in the Department of Anatomical Sciences at Stony Brook who participated in the research.

In addition, its short, under-slung jaw and weak, leaf-shaped teeth show that it probably munched on a diet of plants. While the idea of a gentle, vegetarian crocodile is unusual to us today, the new memoir makes it easy to imagine *Simosuchus* ambling through its semi-arid grassland habitat, pausing to nip at plants and crouching low to hide from predators like the meat-eating dinosaur *Majungasaurus*.

The paleontologists also found evidence that pointed to the evolutionary origin of *Simosuchus*. "Interestingly, an analysis of evolutionary relationships suggests *Simosuchus*' closest relative lived much earlier, in Egypt," said Sertich.

Details like these are crucial to deciphering the pattern of the dispersal of life around the globe, an area of scientific study known as biogeography. Whatever its ancestry, *Simosuchus* has set a surprising new standard for what constitutes a crocodile.

D. W. Krause and N. J. Kley (eds.), *Simosuchus clarki* (Crocodyliformes: Notosuchia) from the Late Cretaceous of Madagascar. Society of Vertebrate Paleontology Memoir 10. Journal of Vertebrate Paleontology 30(6, Supplement).

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

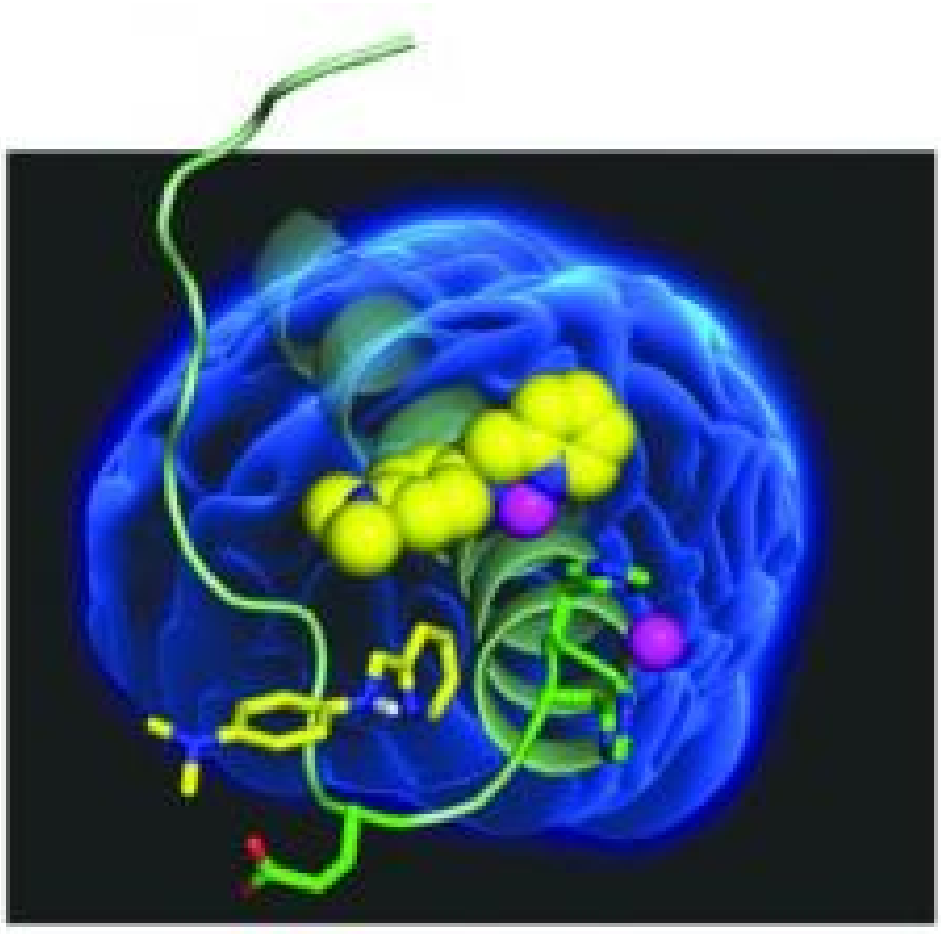
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Stony Brook University**.

Journal Reference:

1. D. W. Krause and N. J. Kley. **Simosuchus clarki (Crocodyliformes: Notosuchia) from the Late Cretaceous of Madagascar**. *Journal of Vertebrate Paleontology*, Society of Vertebrate Paleontology Memoir 10 30(6, Supplement)

http://www.sciencedaily.com/releases/2010/12/101210094416.htm

Unraveling Alzheimer's: Simple Small Molecules Could Untangle Complex Disease



Small Molecules for Metal-Amyloid Species in the Brain. (Credit: Mi Hee Lim and Joseph J. Braymer)

ScienceDaily (Dec. 10, 2010) — New molecular tools developed at the University of Michigan show promise for "cleansing" the brain of amyloid plaques, implicated in Alzheimer's disease.

A hallmark of Alzheimer's disease -- a neurodegenerative disease with no cure -- is the aggregation of protein-like bits known as amyloid-beta peptides into clumps in the brain called plaques. These plaques and their intermediate messes can cause cell death, leading to the disease's devastating symptoms of memory loss and other mental difficulties.

The mechanisms responsible for the formation of these misfolded proteins and their associations with Alzheimer's disease are not entirely understood, but it's thought that copper and zinc ions are somehow involved.

The research, led by assistant professor Mi Hee Lim, was published online Dec. 3 in the *Proceedings of the National Academy of Science.*

In earlier work, Lim and her team developed dual-purpose molecular tools that both grab metal ions and interact with amyloid-beta. The researchers went on to show that in solutions with or without living cells, the molecules were able to regulate copper-induced amyloid-beta aggregation, not only disrupting the formation of clumps, but also breaking up clumps that already had formed.

Building upon that first generation of compounds, Lim and lab members Jung-Suk Choi and Joseph Braymer now report a second generation of compounds that are more stable in biological environments. The researchers tested one of those compounds, described in the PNAS paper, in homogenized brain tissue samples from Alzheimer's disease patients.

"We found that our compound is capable of disassembling the misfolded amyloid clumps to form smaller amyloid pieces, which might be 'cleansed' from the brain more easily, demonstrating a therapeutic application of our compound," said Lim, who has joint appointments in the Life Sciences Institute and the Department of Chemistry. In addition, preliminary tests show that the bi-functional small molecules have a strong potential to cross the blood-brain barrier, the barricade of cells that separates brain tissue from circulating blood, protecting the brain from harmful substances in the bloodstream.

"Crossing this barrier is essential for any treatment like this to be successful," Lim said.

Next steps include more intensive testing of the new compounds for diagnostic and therapeutic properties.

Lim and her team collaborated with Ayyalusamy Ramamoorthy, professor of chemistry and biophysics on this work, with funding from the U-M Horace H. Rackham School of Graduate Studies, the Alzheimer's Art Quilt Initiative, and the National Institutes of Health.

Story Source:

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

Journal Reference:

1. J.-S. Choi, J. J. Braymer, R. P. R. Nanga, A. Ramamoorthy, M. H. Lim. **Design of small molecules that target metal-Aβ species and regulate metal-induced Aβ aggregation and neurotoxicity**. *Proceedings of the National Academy of Sciences*, 2010; DOI: 10.1073/pnas.1006091107

http://www.sciencedaily.com/releases/2010/12/101209130959.htm

Ice-Age Reptile Extinctions Provide a Glimpse of Likely Responses to Human-Caused Climate Change

A sample group of Aegean wall lizards captured during field work on one of the Greek study islands. (Credit: Photo by Johannes Foufopoulos)

ScienceDaily (Dec. 10, 2010) — A wave of reptile extinctions on the Greek islands over the past 15,000 years may offer a preview of the way plants and animals will respond as the world rapidly warms due to human-caused climate change, according to a University of Michigan ecologist and his colleagues.

The Greek island extinctions also highlight the critical importance of preserving habitat corridors that will enable plants and animals to migrate in response to climate change, thereby maximizing their chances of survival.

As the climate warmed at the tail end of the last ice age, sea levels rose and formed scores of Aegean islands that had formerly been part of the Greek mainland. At the same time, cool and moist forested areas dwindled as aridity spread through the region.

In response to the combined effects of a shifting climate, vegetation changes and ever-decreasing island size, many reptile populations perished.

To gain a clearer understanding of the past consequences of climate change, Johannes Foufopoulos (foo FOP oo los) and his colleagues calculated the population extinction rates of 35 reptile species -- assorted lizards, snakes and turtles -- from 87 Greek islands in the northeast Mediterranean Sea. The calculated extinction rates were based on the modern-day presence or absence of each species on islands that were connected to the mainland during the last ice age.

Foufopoulos and his colleagues found a striking pattern to the island extinctions. In most cases, reptile populations disappeared on the smallest islands first -- the places where the habitat choices were most limited.

Especially hard hit were "habitat specialist" reptiles that required a narrow range of environmental conditions to survive. In addition, northern-dwelling species that required cool, moist conditions showed some of the highest extinction rates.

The study results appear in the January edition of *American Naturalist.*

The researchers conclude that a similar pattern of extinctions will emerge at various spots across the globe as the climate warms in the coming decades and centuries. In addition to adapting to a changing climate, plants and animals will be forced to traverse an increasingly fragmented natural landscape.

In many places, small chunks of natural habitat are now surrounded by vast, inhospitable expanses of agricultural and urbanized land, just as those newly formed Aegean islands were surrounded by rising seas thousands of years ago.

"The widespread fragmentation of natural habitats greatly exacerbates the effects of climate change and undermines the ability of species to adapt to the new conditions," said Foufopoulos, an associate professor at the U-M School of Natural Resources and Environment and the Department of Ecology and Evolutionary Biology.

In addition to Foufopoulos, the paper's authors are Anthony Ives of the University of Wisconsin and A. Marm Kilpatrick of the University of California, Santa Cruz.

"The lessons learned from the wave of reptile extinctions suggest that if species are to survive the global climate shift already underway, not only do humans have to set significantly more land aside for conservation, but these protected areas will also need to be connected through a network of habitat corridors that allow species migration," Foufopoulos said.

Over the last several decades, global warming has resulted in a poleward shift in the range of many birds, butterflies and other creatures. This shift to cooler climes -- northward in the Northern Hemisphere and southward in the Southern Hemisphere -- is expected to continue in the future as organisms seek out places where temperature and moisture levels permit their survival.

Funding for the project was provided through the University of Wisconsin's Department of Zoology, the University of Michigan, the Princeton Environmental Institute, the Cleveland Dodge Foundation and the U.S. National Science Foundation.

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

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

Journal Reference:

1. Johannes Foufopoulos, A. Marm Kilpatrick, Anthony R. Ives. **Climate Change and Elevated Extinction Rates of Reptiles from Mediterranean Islands**. *The American Naturalist*, 2011; 177 (1): 119 DOI: 10.1086/657624

http://www.sciencedaily.com/releases/2010/12/101209141243.htm

World's Smallest Battery: Real-Time Observation of Nanowire Anode to Help Improve Lithium Batteries

The Medusa twist: formerly unobserved increase in length and twist of the anode in a nanobattery. (Credit: Courtesy DOE Center for Integrated Nanotechnologies)

ScienceDaily (Dec. 10, 2010) — A benchtop version of the world's smallest battery -- its anode a single nanowire one seven-thousandth the thickness of a human hair -- has been created by a team led by Sandia National Laboratories researcher Jianyu Huang.

To better study the anode's characteristics, the tiny rechargeable, lithium-based battery was formed inside a transmission electron microscope (TEM) at the Center for Integrated Nanotechnologies (CINT), a Department of Energy research facility jointly operated by Sandia and Los Alamos national laboratories.

Says Huang of the work, reported in the Dec. 10 issue of the journal *Science,* "This experiment enables us to study the charging and discharging of a battery in real time and at atomic scale resolution, thus enlarging our understanding of the fundamental mechanisms by which batteries work."

Because nanowire-based materials in lithium ion batteries offer the potential for significant improvements in power and energy density over bulk electrodes, more stringent investigations of their operating properties should improve new generations of plug-in hybrid electric vehicles, laptops and cell phones.

"What motivated our work," says Huang, "is that lithium ion batteries [LIB] have very important applications, but the low energy and power densities of current LIBs cannot meet the demand. To improve performance, we wanted to understand LIBs from the bottom up, and we thought in-situ TEM could bring new insights to the problem."

Battery research groups do use nanomaterials as anodes, but in bulk rather than individually -- a process, Huang says, that resembles "looking at a forest and trying to understand the behavior of an individual tree."

The tiny battery created by Huang and co-workers consists of a single tin oxide nanowire anode 100 nanometers in diameter and 10 micrometers long, a bulk lithium cobalt oxide cathode three millimeters long, and an ionic liquid electrolyte. The device offers the ability to directly observe change in atomic structure during charging and discharging of the individual "trees."

An unexpected find of the researchers was that the tin oxide nanowire rod nearly doubles in length during charging -- far more than its diameter increases -- a fact that could help avoid short circuits that may shorten battery life. "Manufacturers should take account of this elongation in their battery design," Huang said. (The common belief of workers in the field has been that batteries swell across their diameter, not longitudinally.)

Huang's group found this flaw by following the progression of the lithium ions as they travel along the nanowire and create what researchers christened the "Medusa front" -- an area where high density of mobile dislocations cause the nanowire to bend and wiggle as the front progresses. The web of dislocations is caused by lithium penetration of the crystalline lattice. "These observations prove that nanowires can sustain large

stress (>10 GPa) induced by lithiation without breaking, indicating that nanowires are very good candidates for battery electrodes," said Huang.

"Our observations -- which initially surprised us -- tell battery researchers how these dislocations are generated, how they evolve during charging, and offer guidance in how to mitigate them," Huang said. "This is the closest view to what's happening during charging of a battery that researcher have achieved so far."

Lithiation-induced volume expansion, plasticity and pulverization of electrode materials are the major mechanical defects that plague the performance and lifetime of high-capacity anodes in lithium-ion batteries, Huang said. "So our observations of structural kinetics and amorphization [the change from normal crystalline structure] have important implications for high-energy battery design and in mitigating battery failure."

The electronic noise level generated from the researchers' measurement system was too high to read electrical currents, but Sandia co-author John Sullivan estimated a current level of a picoampere flowing in the nanowire during charging and discharging. The nanowire was charged to a potential of about 3.5 volts, Huang said.

A picoampere is a millionth of a microampere. A microampere is a millionth of an ampere.

The reason that atomic-scale examination of the charging and discharging process of a single nanowire had not been possible was because the high vacuum in a TEM made it difficult to use a liquid electrolyte. Part of the Huang group's achievement was to demonstrate that a low-vapor-pressure ionic liquid -- essentially, molten salt -- could function in the vacuum environment.

Although the work was carried out using tin oxide (SnO_2) nanowires, the experiments can be extended to other materials systems, either for cathode or anode studies, Huang said.

"The methodology that we developed should stimulate extensive real-time studies of the microscopic processes in batteries and lead to a more complete understanding of the mechanisms governing battery performance and reliability," he said. "Our experiments also lay a foundation for in-situ studies of electrochemical reactions, and will have broad impact in energy storage, corrosion, electrodeposition and general chemical synthesis research field."

Other researchers contributing to this work include Xiao Hua Liu, Nicholas Hudak, Arunkumar Subramanian and Hong You Fan, all of Sandia; Li Zhong, Scott Mao and Li Qiang Zhang of the University of Pittsburgh; Chong Min Wang and Wu Xu of Pacific Northwest National Laboratory; and Liang Qi, Akihiro Kushima and Ju Li of the University of Pennsylvania.

Funding came from Sandia's Laboratory Directed Research and Development Office and the Department of Energy's Office of Science through the Center for Integrated Nanotechnologies and the Energy Frontier Research Centers program.

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Story Source:

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Journal Reference:

1. Jian Yu Huang, Li Zhong, Chong Min Wang, John P. Sullivan, Wu Xu, Li Qiang Zhang, Scott X. Mao, Nicholas S. Hudak, Xiao Hua Liu, Arunkumar Subramanian, Hongyou Fan, Liang Qi, Akihiro Kushima, and Ju Li. **In Situ Observation of the Electrochemical Lithiation of a Single SnO_2 Nanowire Electrode**. *Science*, 2010; 330 (6010): 1515-1520 DOI: 10.1126/science.1195628

http://www.sciencedaily.com/releases/2010/12/101209152751.htm

Cloud 'Feedback' Affects Global Climate and Warming

Changes in clouds will amplify the warming of the planet due to human activities, according to new research. (Credit: iStockphoto/Tamara Kulikova)

ScienceDaily (Dec. 10, 2010) — Changes in clouds will amplify the warming of the planet due to human activities, according to a breakthrough study by a Texas A&M University researcher.

Andrew Dessler, a professor in the Department of Atmospheric Sciences, says that warming due to increases in greenhouse gases will cause clouds to trap more heat, which will lead to additional warming. This process is known as the "cloud feedback" and is predicted to be responsible for a significant portion of the warming over the next century.

Dessler used measurements from the Clouds and the Earth's Radiant Energy System (CERES) instrument onboard NASA's Terra satellite to calculate the amount of energy trapped by clouds as the climate varied over the last decade. He also used meteorological analyses provided by NASA's Modern Era Retrospective-Analysis for Research and Applications (MERRA) and by the European Center for Medium-Range Weather Forecasts.

"It's a vicious cycle -- warmer temperatures mean clouds trap more heat, which in turn leads to even more warming," Dessler explains. His work is published in the Dec. 10 issue of *Science* magazine and is supported by a NASA research grant.

While climate models had long predicted that the cloud feedback would amplify warming from human activities, until recently it was impossible to test the models using observations.

"This work suggests that climate models are doing a pretty decent job simulating how clouds respond to changing climates," Dessler says.

Some prominent climate skeptics have recently been arguing that clouds would act to stabilize the climate, thereby preventing greenhouse gases from causing significant warming.

"Based on my results, I think the chances that clouds will save us from dramatic climate change are pretty low," he explains. "In fact, my work shows that clouds will likely be amplifying the warming from human activities.

"I think we can be pretty confident that temperatures will rise by several degrees Celsius over the next century if we continue our present trajectory of greenhouse gas emissions."

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

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

Journal Reference:

1. A. E. Dessler. **A Determination of the Cloud Feedback from Climate Variations over the Past Decade**. *Science*, 10 December 2010: 1523-1527 DOI: 10.1126/science.1192546

http://www.sciencedaily.com/releases/2010/12/101209141231.htm

New Insights Into Formation of Earth, the Moon, and Mars

Artist's concept of rocky planets. New research reveals that the abundance of so-called highly siderophile, or metal-loving, elements like gold and platinum found in the mantles of Earth, the Moon and Mars were delivered by massive impactors during the final phase of planet formation over 4.5 billion years ago. (Credit: NASA/JPL-Caltech)

ScienceDaily (Dec. 10, 2010) — New research reveals that the abundance of so-called highly siderophile, or metal-loving, elements like gold and platinum found in the mantles of Earth, the Moon and Mars were delivered by massive impactors during the final phase of planet formation over 4.5 billion years ago. The predicted sizes of the projectiles, which hit within tens of millions of years of the giant impact that produced our Moon, are consistent with current planet formation models as well as physical evidence such as the size distributions of asteroids and ancient Martian impact scars.

They predict that the largest of the late impactors on Earth -- at 1,500 to 2,000 miles in diameter -- potentially modified Earth's obliquity by approximately 10 degrees, while those for the Moon, at approximately 150-200 miles, may have delivered water to its mantle.

The team that conducted this study comprises solar system dynamicists, such as Dr. William Bottke and Dr. David Nesvorny from the Southwest Research Institute, and geophysical-geochemical modelers, such as Prof. Richard J. Walker from the University of Maryland, Prof. James Day from the University of Maryland and Scripps Institution of Oceanography, and Prof. Linda Elkins-Tanton, from the Massachusetts Institute of Technology. Together, they represent three teams within the NASA Lunar Science Institute (NLSI).

A fundamental problem in planetary science is to determine how Earth, the Moon, and other inner solar system planets formed and evolved. This is a difficult question to answer given that billions of years of history have steadily erased evidence for these early events. Despite this, critical clues can still be found to help determine what happened, provided one knows where to look.

For instance, careful study of lunar samples brought back by the Apollo astronauts, combined with numerical modeling work, indicates that the Moon formed as a result of a collision between a Mars-sized body and the early Earth about 4.5 billion years ago. While the idea that the Earth-Moon system owes its existence to a single, random event was initially viewed as radical, it is now believed that such large impacts were commonplace during the end stages of planet formation. The giant impact is believed to have led to a final phase of core formation and global magma oceans on both the Earth and Moon.

For the giant impact hypothesis to be correct, one might expect samples from the Earth and Moon's mantle, brought to the surface by volcanic activity, to back it up. In particular, scientists have examined the abundance in these rocks of so-called highly siderophile, or metal-loving, elements: Re, Os, Ir, Ru, Pt, Rh, Pd, Au. These elements should have followed the iron and other metals to the core in the aftermath of the Moon-forming event, leaving the rocky crusts and mantles of these bodies void of these elements. Accordingly, their near-absence from mantle rocks should provide a key test of the giant impact model.

However, as described by team member Walker, "The big problem for the modelers is that these metals are not missing at all, but instead are modestly plentiful." Team member Day adds, "This is a good thing for anyone who likes their gold wedding rings or the cleaner air provided by the palladium in their car's catalytic convertors."

A proposed solution to this conundrum is that highly siderophile elements were indeed stripped from the mantle by the effects of the giant impact, but were then partially replenished by later impacts from the original building blocks of the planets, called planetesimals. This is not a surprise -- planet formation models predict such late impacts -- but their nature, numbers, and most especially size of the accreting bodies are unknown. Presumably, they could have represented the accretion of many small bodies or a few large events. To match observations, the late-arriving planetesimals need to deliver 0.5 percent of the Earth's mass to Earth's mantle, equivalent to one-third of the mass of the Moon, and about 1,200 times less mass to the Moon's mantle.

Using numerical models, the team showed that they could reproduce these amounts if the late accretion population was dominated by massive projectiles. Their results indicate the largest Earth impactor was 1,500-2,000 miles in diameter, roughly the size of Pluto, while those hitting the Moon were only 150-200 miles across. Lead author Bottke says, "These impactors are thought to be large enough to produce the observed enrichments in highly siderophile elements, but not so large that their fragmented cores joined with the planet's core. They probably represent the largest objects to hit those worlds since the giant impact that formed our Moon."

Intriguingly, the predicted distribution of projectile sizes, where most of the mass of the population is found among the largest objects, is consistent with other evidence.

- New models describing how planetesimals form and evolve suggest the biggest ones efficiently gobble up the smaller ones and run away in terms of size, leaving behind a population of enormous objects largely resistant to collisional erosion.
- The last surviving planetesimal populations in the inner solar system are the asteroids. In the inner asteroid belt, the asteroids Ceres, Pallas and Vesta, at 600, 300 and 300 miles across, respectively, dwarf the next largest asteroids at 150 miles across. No asteroids with "in-between" sizes are observed in this region.
- The sizes of the oldest and largest craters on Mars, many of which are thousands of miles across, are consistent with it being bombarded by an inner asteroid belt-like population dominated by large bodies early in its history.

These results make it possible to make some interesting predictions about the evolution of the Earth, Mars and the Moon. For example:

- The largest projectiles that struck Earth were capable of modifying its spin axis, on average, by approximately 10 degrees.
- The largest impactor to strike Mars, according to this work and the abundance of highly siderophile elements found in Martian meteorites, was 900-1,100 miles across. This is approximately the projectile size needed to create the proposed Borealis basin that may have produced Mars' global hemispheric dichotomy.

- For the Moon, the projectiles would have been large enough to have created the South-Pole-Aitkin basin or perhaps a comparable-sized early basin. Moreover, if they contained even a trace amount of volatiles, then the same processes that brought highly siderophile elements to the Moon's mantle may have also delivered its observed abundance of water.

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

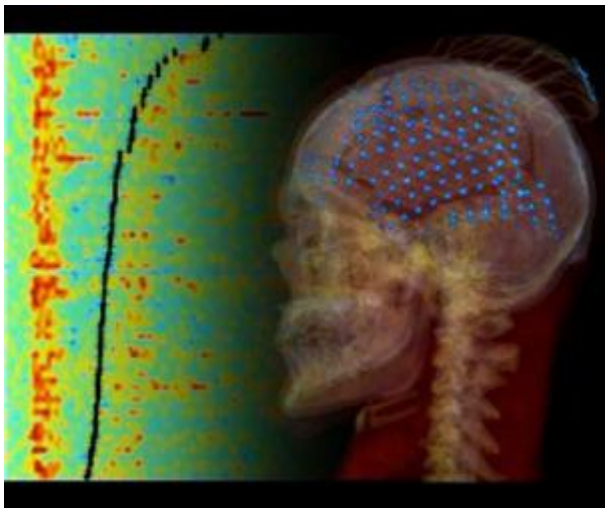
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Southwest Research Institute**.

Journal Reference:

1. William F. Bottke, Richard J. Walker, James M. D. Day, David Nesvorny, and Linda Elkins-Tanton. **Stochastic Late Accretion to Earth, the Moon, and Mars**. *Science*, 10 December 2010: 1527-1530 DOI: 10.1126/science.1196874

http://www.sciencedaily.com/releases/2010/12/101209141130.htm

Our Brains Are Wired So We Can Better Hear Ourselves Speak



Activity in the auditory cortex when we speak and listen is amplified in some regions of the brain and muted in others. In this image, the black line represents muting activity when we speak. (Credit: Courtesy of Adeen Flinker)

ScienceDaily (Dec. 9, 2010) — Like the mute button on the TV remote control, our brains filter out unwanted noise so we can focus on what we're listening to. But when it comes to following our own speech, a new brain study from the University of California, Berkeley, shows that instead of one homogenous mute button, we have a network of volume settings that can selectively silence and amplify the sounds we make and hear.

Neuroscientists from UC Berkeley, UCSF and Johns Hopkins University tracked the electrical signals emitted from the brains of hospitalized epilepsy patients. They discovered that neurons in one part of the patients' hearing mechanism were dimmed when they talked, while neurons in other parts lit up.

Their findings, published Dec. 8, 2010 in the *Journal of Neuroscience*, offer new clues about how we hear ourselves above the noise of our surroundings and monitor what we say. Previous studies have shown a selective auditory system in monkeys that can amplify their self-produced mating, food and danger alert calls, but until this latest study, it was not clear how the human auditory system is wired.

"We used to think that the human auditory system is mostly suppressed during speech, but we found closely knit patches of cortex with very different sensitivities to our own speech that paint a more complicated picture," said Adeen Flinker, a doctoral student in neuroscience at UC Berkeley and lead author of the study.

"We found evidence of millions of neurons firing together every time you hear a sound right next to millions of neurons ignoring external sounds but firing together every time you speak," Flinker added. "Such a mosaic of responses could play an important role in how we are able to distinguish our own speech from that of others."

While the study doesn't specifically address why humans need to track their own speech so closely, Flinker theorizes that, among other things, tracking our own speech is important for language development, monitoring what we say and adjusting to various noise environments.

"Whether it's learning a new language or talking to friends in a noisy bar, we need to hear what we say and change our speech dynamically according to our needs and environment," Flinker said.

He noted that people with schizophrenia have trouble distinguishing their own internal voices from the voices of others, suggesting that they may lack this selective auditory mechanism. The findings may be helpful in better understanding some aspects of auditory hallucinations, he said.

Moreover, with the finding of sub-regions of brain cells each tasked with a different volume control job -- and located just a few millimeters apart -- the results pave the way for a more detailed mapping of the auditory cortex to guide brain surgery.

In addition to Flinker, the study's authors are Robert Knight, director of the Helen Wills Neuroscience Institute at UC Berkeley; neurosurgeons Edward Chang, Nicholas Barbaro and neurologist Heidi Kirsch of the University of California, San Francisco; and Nathan Crone, a neurologist at Johns Hopkins University in Maryland.

The auditory cortex is a region of the brain's temporal lobe that deals with sound. In hearing, the human ear converts vibrations into electrical signals that are sent to relay stations in the brain's auditory cortex where they are refined and processed. Language is mostly processed in the left hemisphere of the brain.

In the study, researchers examined the electrical activity in the healthy brain tissue of patients who were being treated for seizures. The patients had volunteered to help out in the experiment during lulls in their treatment, as electrodes had already been implanted over their auditory cortices to track the focal points of their seizures.

Researchers instructed the patients to perform such tasks as repeating words and vowels they heard, and recorded the activity. In comparing the activity of electrical signals discharged during speaking and hearing, they found that some regions of the auditory cortex showed less activity during speech, while others showed the same or higher levels.

"This shows that our brain has a complex sensitivity to our own speech that helps us distinguish between our vocalizations and those of others, and makes sure that what we say is actually what we meant to say," Flinker said.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

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.

Journal Reference:

1. A. Flinker, E. F. Chang, H. E. Kirsch, N. M. Barbaro, N. E. Crone, R. T. Knight. **Single-Trial Speech Suppression of Auditory Cortex Activity in Humans**. *Journal of Neuroscience*, 2010; 30 (49): 16643 DOI: 10.1523/JNEUROSCI.1809-10.2010

http://www.sciencedaily.com/releases/2010/12/101209101515.htm

Politics and Eye Movement: Liberals Focus Their Attention on 'Gaze Cues' Much Differently Than Conservatives Do

In a new study, researchers measured both liberals' and conservatives' reaction to "gaze cues" -- a person's tendency to shift attention in a direction consistent with another person's eye movements. Liberals responded strongly to the prompts, consistently moving their attention in the direction suggested to them by a face on a computer screen. Conservatives, on the other hand, did not. (Credit: iStockphoto/Ivan Grlic)

ScienceDaily (Dec. 9, 2010) — It goes without saying that conservatives and liberals don't see the world in the same way. Now, research from the University of Nebraska-Lincoln suggests that is exactly, and quite literally, the case.

In a new study, UNL researchers measured both liberals' and conservatives' reaction to "gaze cues" -- a person's tendency to shift attention in a direction consistent with another person's eye movements, even if it's irrelevant to their current task -- and found big differences between the two groups.

Liberals responded strongly to the prompts, consistently moving their attention in the direction suggested to them by a face on a computer screen. Conservatives, on the other hand, did not.

Why? Researchers suggested that conservatives' value on personal autonomy might make them less likely to be influenced by others, and therefore less responsive to the visual prompts.

"We thought that political temperament may moderate the magnitude of gaze-cuing effects, but we did not expect conservatives to be completely immune to these cues," said Michael Dodd, a UNL assistant professor of psychology and the lead author of the study.

Liberals may have followed the "gaze cues," meanwhile, because they tend to be more responsive to others, the study suggests.

"This study basically provides one more piece of evidence that liberals and conservatives perceive the world, and process information taken in from that world, in different ways," said Kevin Smith, UNL professor of political science and one of the study's authors.

"Understanding exactly why people have such different political perspectives and where those differences come from may help us better understand the roots of a lot of political conflict."

The study involved 72 people who sat in front of a white computer screen and were told to fixate on a small black cross in its center. The cross then disappeared and was replaced by a drawing of a face, but with eyes

missing their pupils. Then, pupils appeared in the eyes, looking either left or right. Finally, a small, round target would appear either on the left or right side of the face drawing.

Dodd said the participants were told that the gaze cues in the study did not predict where the target would appear, so there was no reason for participants to attend to them. "But the nature of social interaction tends to make it very difficult to ignore the cues, even when they're meaningless," he said.

As soon as they saw the target, participants would tap the space bar on their keyboard, giving researchers information on their susceptibility to the "gaze cues." Each sequence, which lasted a few hundred milliseconds, was repeated hundreds of times.

Afterward, participants were surveyed on their beliefs on a range of political issues to establish their political ideology.

In addition to shedding light on the differences between the two political camps, researchers said the results add to growing indications that suggest biology plays a role determining one's political direction. Previous UNL research has delved into the physiology of political orientation, showing that those highly responsive to threatening images are likely to support defense spending, capital punishment, patriotism and the Iraq War.

Traditionally, political scientists have accounted for political differences purely in terms of environmental forces, but this study shows the potential role of cognitive biases -- wherever they may come from -- as a relevant area of future research.

"Getting things done in politics typically depends on competing viewpoints finding common ground," Smith said. "Our research is suggesting that's a lot tougher than it sounds, because the same piece of ground can look very different depending on which ideological hill you view it from."

The study, funded in part by the National Science Foundation, is in a forthcoming edition of the journal *Attention, Perception & Psychophysics* and is authored by UNL's Dodd, Smith and John R. Hibbing.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

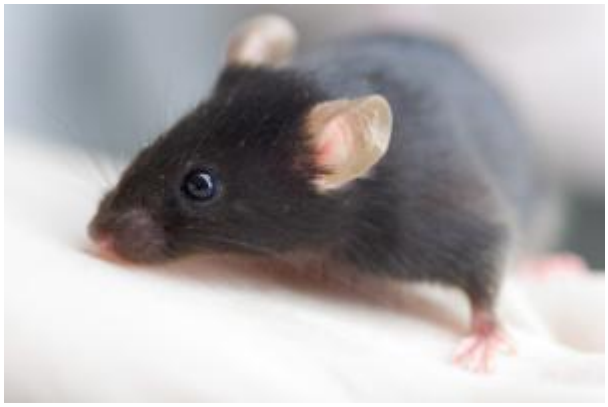
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Nebraska-Lincoln**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Michael D. Dodd, John R. Hibbing and Kevin B. Smith. **The politics of attention: gaze-cuing effects are moderated by political temperament**. *Attention, Perception & Psychophysics*, 2010; DOI: 10.3758/s13414-010-0001-x

http://www.sciencedaily.com/releases/2010/12/101209074403.htm

Viable Female and Male Mice from Two Fathers Produced Using Stem Cell Technology



Lab mouse. (Credit: iStockphoto)

ScienceDaily (Dec. 9, 2010) — Using stem cell technology, reproductive scientists in Texas, led by Dr. Richard R. Behringer at the M.D. Anderson Cancer Center, have produced male and female mice from two fathers.

The study was posted online Dec. 8 in the journal *Biology of Reproduction*.

The achievement of two-father offspring in a species of mammal could be a step toward preserving endangered species, improving livestock breeds, and advancing human assisted reproductive technology (ART). It also opens the provocative possibility of same-sex couples having their own genetic children, the researchers note.

In the new work, the Behringer team manipulated fibroblasts from a male (XY) mouse fetus to produce an induced pluripotent stem (iPS) cell line. About one percent of iPS cell colonies grown from this XY cell line spontaneously lost the Y chromosome, resulting in XO cells. The XO iPS cells were injected into blastocysts from donor female mice. The treated blastocysts were transplanted into surrogate mothers, which gave birth to female XO/XX chimeras having one X chromosome from the original male mouse fibroblast.

The female chimeras, carrying oocytes derived from the XO cells, were mated with normal male mice. Some of the offspring were male and female mice that had genetic contributions from two fathers.

According to the authors, "Our study exploits iPS cell technologies to combine the alleles from two males to generate male and female progeny, i.e. a new form of mammalian reproduction."

The technique described in this study could be applied to agriculturally important animal species to combine desirable genetic traits from two males without having to outcross to females with diverse traits.

"It is also possible that one male could produce both oocytes and sperm for self-fertilization to generate male and female progeny," the scientists point out. Such a technique could be valuable for preserving species when no females remain.

In the future, it may also be possible to generate human oocytes from male iPS cells in vitro. Used in conjunction with in vitro fertilization, this would eliminate the need for female XO/XX chimeras, although a surrogate mother would still be needed to carry the two-father pregnancy to term.

Using a variation of the iPS technique, the researchers say "it may also be possible to generate sperm from a female donor and produce viable male and female progeny with two mothers."

The authors also caution that the "generation of human iPS cells still requires significant refinements prior to their use for therapeutic purposes."

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Story Source:

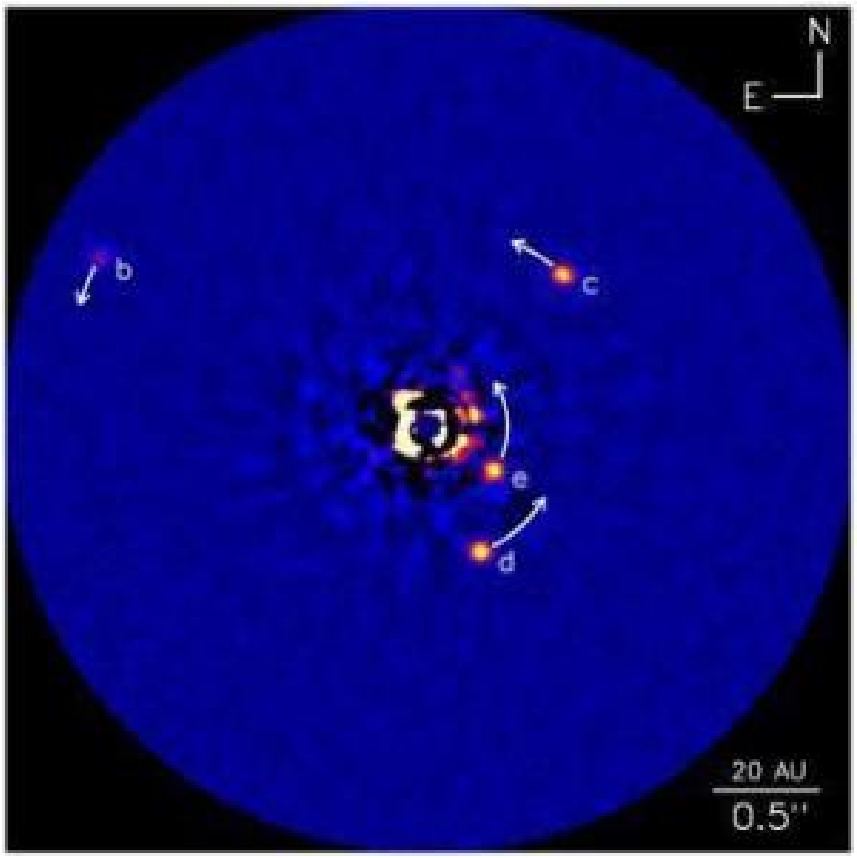
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Society for the Study of Reproduction**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Jian Min Deng, Kei Satoh, Hao Chang, Zhaoping Zhang, M. David Stewart, Hongran Wang, Austin J. Cooney, and Richard R. Behringer. **Generation of Viable Male and Female Mice from Two Fathers**. *Biology of Reproduction*, 110.088831, Dec 8, 2010 DOI: 10.1095/biolreprod.110.088831

http://www.sciencedaily.com/releases/2010/12/101208151611.htm

Astronomers Discover, Image New Planet in Planetary System Very Similar to Our Own



Four planets orbit star HR 8799: Three planets (b, c, and d) and newly discovered planet "e" orbit a star some 129 light years from Earth. The curved arrows represent the coming 10 years of orbital motion for the planets. 20 AU refers to 20 times the distance from the Earth to the sun. This image was obtained using the W.M. Keck II telescope at Mauna Kea Observatory in Hawaii. (Credit: NRC-HIA, C. Marois, and Keck Observatory)

ScienceDaily (Dec. 9, 2010) — An international team of astronomers has discovered and imaged a fourth giant planet outside our solar system, a discovery that further strengthens the remarkable resemblances between a distant planetary system and our own.

The research is published Dec. 8 in the advance online version of the journal *Nature*.

The astronomers say the planetary system resembles a supersized version of our solar system.

"Besides having four giant planets, both systems also contain two 'debris belts' composed of small rocky or icy objects, along with lots of tiny dust particles," said Benjamin Zuckerman, a UCLA professor of physics and astronomy and co-author of the Nature paper.

Our giant planets are Jupiter, Saturn, Uranus and Neptune, and our debris belts include the asteroid belt between the orbits of Mars and Jupiter and the Kuiper Belt, beyond Neptune's orbit.

The newly discovered fourth planet (known as HR 8799e) orbits a bright star called HR 8799, which lies some 129 light years from Earth and is faintly visible to the naked eye. The mass of the HR 8799 planetary system is much greater than our own. Astronomers estimate that the combined mass of the four giant planets may be 20 times greater than the mass of all the planets in our solar system, and the debris belt counterparts also contain much more mass than our own.

The new planet joins three previously discovered planets that were the subjects of a 2008 paper in the journal Science reporting the first-ever images of a planetary family orbiting a star other than our sun. Four of the co-authors of the new Nature paper, including Zuckerman, were also co-authors on that Science paper.

"This is the fourth imaged planet in this planetary system, and only a tiny percentage of known exoplanets (planets outside our solar system) have been imaged; none has been imaged in multiple-planet systems other than those of HR 8799," Zuckerman said.

All four planets orbiting HR 8799 are similar in size, likely between five and seven times the mass of Jupiter. The newly discovered planet orbits HR 8799 more closely than the other three. If it were in orbit around our sun, astronomers say, it would lie between the orbits of Saturn and Uranus.

The astronomers used the Keck II telescope at Hawaii's W.M. Keck Observatory to obtain images of the fourth planet. Zuckerman's colleagues are from Canada's National Research Council (NRC), Lawrence Livermore National Laboratory (LLNL) in California, and Lowell Observatory in Arizona.

"We reached a milestone in the search for other worlds in 2008 with the discovery of the HR 8799 planetary system," said Christian Marois, an NRC astronomer and lead author of the Nature paper. "The images of this new inner planet are the culmination of 10 years' worth of innovation, making steady progress to optimize every aspect of observation and analysis. This allows us to detect planets located ever closer to their stars and ever further from our own solar system."

"The four massive planets pull on each other gravitationally," said co-author Quinn Konopacky, a postdoctoral researcher at LLNL. "We don't yet know if the system will last for billions of years or fall apart in a few million more. As astronomers carefully follow the HR 8799 planets during the coming decades, the question of the stability of their orbits could become much clearer."

The origin of these four giant planets remains a puzzle; neither of the two main models of planet formation can account for all four.

"There's no simple model that can form all four planets at their current location," said co-author Bruce Macintosh of LLNL. "It's going to be a challenge for our theoretical colleagues."

It is entirely plausible that this planetary system contains additional planets closer to the star than these four planets, quite possibly rocky, Earth-like planets, Zuckerman said. But such interior planets are far more difficult to detect, he added.

"Images like these bring the exoplanet field, which studies planets outside our solar system, into an era of exoplanet characterization," said co-author Travis Barman, a Lowell Observatory exoplanet theorist. "Astronomers can now directly examine the atmospheric properties of four giant exoplanets that are all the same young age and that formed from the same building materials."

Detailed study of the properties of HR 8799e will be challenging due to the planet's relative faintness and its proximity to its star. To overcome those limitations, Macintosh is leading an effort to build an advanced exoplanet imager, called the Gemini Planet Imager, for the Gemini Observatory. This new instrument will

physically block the starlight and allow quick detection and detailed characterization of planets similar to HR 8799e. UCLA and the NRC are also contributing to Gemini Planet Imager.

James Larkin, a UCLA professor of physics and astronomy, is building a major component of the imager, which is scheduled to arrive at the Gemini South Telescope in Chile late next year.

The research reported in Nature was funded by NASA, the U.S. Department of Energy and the National Science Foundation Center for Adaptive Optics.

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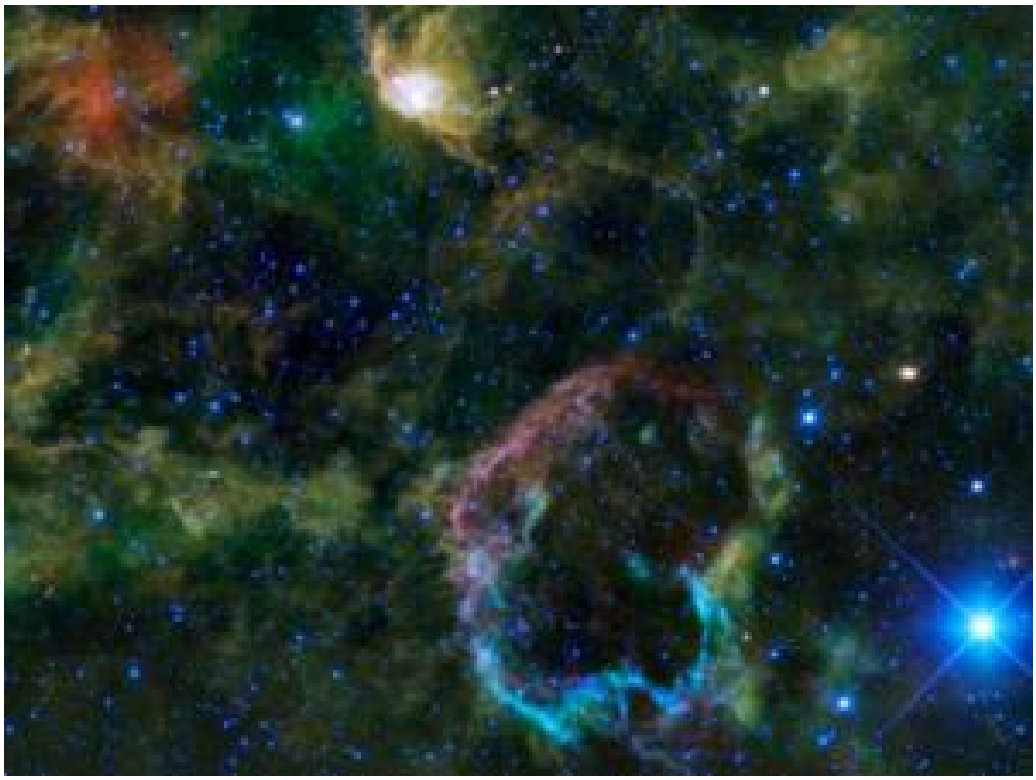
Journal Reference:

1. Christian Marois, B. Zuckerman, Quinn M. Konopacky, Bruce Macintosh, Travis Barman. **Images of a fourth planet orbiting HR 8799**. *Nature*, 2010; DOI: 10.1038/nature09684

http://www.sciencedaily.com/releases/2010/12/101208172320.htm

WISE Sees an Explosion of Infrared Light



This oddly colorful nebula is the supernova remnant IC 443 as seen by NASA's Wide-field Infrared Survey Explorer, or WISE. (Credit: NASA/JPL-Caltech/UCLA)

ScienceDaily (Dec. 10, 2010) — A circular rainbow appears like a halo around an exploded star in a new view of the IC 443 nebula from NASA's Wide-field Infrared Survey Explorer, or WISE.

When massive stars die, they explode in tremendous blasts, called supernovae, which send out shock waves. The shock waves sweep up and heat surrounding gas and dust, creating supernova remnants like the one pictured in the new image. The supernova in IC 443 happened somewhere between 5,000 and 10,000 years ago.

In this WISE image, infrared light has been color-coded to reveal what our eyes cannot see. The colors differ primarily because materials surrounding the supernova remnant vary in density. When the shock waves hit these materials, different gases were triggered to release a mix of infrared wavelengths.

The supernova remnant's northeastern shell, seen here as the violet-colored semi-circle at top left, is composed of sheet-like filaments that are emitting light from iron, neon, silicon and oxygen gas atoms and dust particles heated by a fast shock wave traveling at about 100 kilometers per second, or 223,700 mph.

The smaller southern shell, seen in bright bluish colors, is constructed of clumps and knots primarily emitting light from hydrogen gas and dust heated by a slower shock wave traveling at about 30 kilometers per second, or 67,100 miles per hour. In the case of the southern shell, the shock wave is interacting with a nearby dense cloud. This cloud can be seen in the image as the greenish dust cutting across IC 443 from the northwest to southeast.

IC 443 can be found near the star Eta Geminorum, which lies near Castor, one of the twins in the constellation Gemini.

NASA's Jet Propulsion Laboratory, Pasadena, Calif., manages and operates the Wide-field Infrared Survey Explorer for NASA's Science Mission Directorate, Washington. The principal investigator, Edward Wright, is at UCLA. The mission was competitively selected under NASA's Explorers Program managed by the Goddard Space Flight Center, Greenbelt, Md. The science instrument was built by the Space Dynamics Laboratory, Logan, Utah, and the spacecraft was built by Ball Aerospace & Technologies Corp., Boulder, Colo. Science operations and data processing take place at the Infrared Processing and Analysis Center at the California Institute of Technology in Pasadena. Caltech manages JPL for NASA. More information is online at http://www.nasa.gov/wise and http://wise.astro.ucla.edu and http://www.jpl.nasa.gov/wise .

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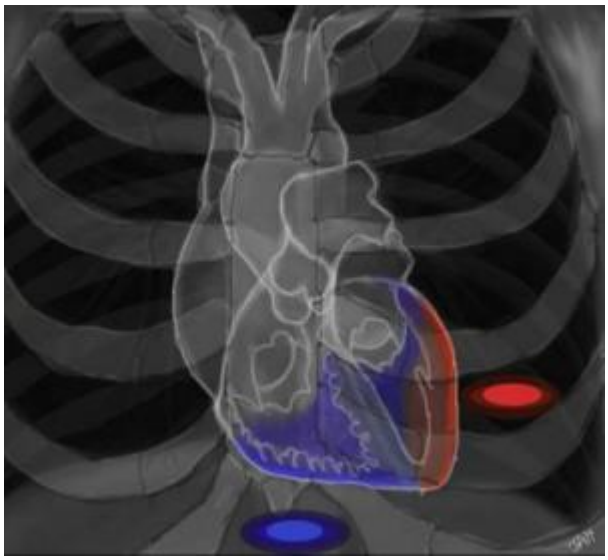
http://www.sciencedaily.com/releases/2010/12/101210114531.htm

New Hybrid, Precision Heart Procedures to Help Stop Deadly Arrhythmias



This is a schematic of the heart showing the minimally invasive approaches to allow access to the surface of the heart (the blue and red areas) during this hybrid cardiac procedure. (Credit: UCLA)

ScienceDaily (Dec. 10, 2010) — New techniques now being used at UCLA allow doctors to more precisely target certain areas of the heart to stop ventricular arrhythmias -- serious abnormal rhythms in the heart's lower chambers -- in high-risk patients.

Generally, arrhythmias can be controlled by medications, and sometimes defibrillators. But a potentially life-threatening, recurrent arrhythmia known as a ventricular tachycardia, which originates in one of the heart's two ventricles, can produce a fast heart beat that requires other interventions, such as catheter ablation, in which the precise focus area of the arrhythmia must be controlled.

Cardiologists will often use catheter ablation once medications and other therapies have failed. The procedure involves the insertion of a tiny, metal-tipped catheter through a vein in the groin or neck to reach the inside of the heart. Prior to the procedure, electrical tests are conducted on the heart to identify and map the exact site of the arrhythmia's origin.

While ablation is usually performed inside the heart, in about 15 to 30 percent of patients with dangerous ventricular tachycardias, the site responsible for the abnormal rhythm is on the heart's outer surface. Normally, this can be addressed by an ablation procedure, performed in a cardiac catheterization lab, in which doctors thread a wire with a metal-tipped catheter inside the body, under the ribcage, to apply heat or cold to the area of the heart's ventricle that is producing the arrhythmia, stopping it.

However, in high-risk patients who have scarring from previous heart surgeries, it is difficult to reach the outside of the heart. To tackle this problem, a team at UCLA has devised a hybrid approach combining catheter ablation with minimally invasive surgical techniques.

"UCLA is at the forefront of developing and using new techniques and approaches to better access a high-risk patient's heart to stop difficult-to-reach, life-threatening arrhythmias," said Dr.. Kalyanam Shivkumar, professor of medicine and radiological sciences and director of the UCLA Cardiac Arrhythmia Center and Electrophysiology Programs.

A study in the November issue of the journal *Heart Rhythm* reports on UCLA's experience with the two newer surgical methods, used together with catheter ablation, in 14 high-risk patients who had ventricular arrhythmias treated between September 2004 and March 2010.

In order to perform more accurate electrical mapping of the heart and apply precise ablation therapy in hard-to-reach areas in high-risk patients, surgeons used one of two minimally-invasive cardiac surgical techniques to open a small window in the chest to view the heart. Depending on the area of the heart the team needed to

access, they used either a procedure called a subxiphoid window or one known as a limited anterior thoracotomy.

The ability to directly visualize the heart and navigate around scar tissue and blood vessels to get closer to the heart's surface, significantly improved accuracy in applying the ablation techniques to stop the arrhythmias.

"These newer, more minimally-invasive procedures offer more treatments for high-risk patients who don't have a lot of options to address a life-threatening arrhythmia, allowing them to avoid potential open heart surgery," Shivkumar said.

The hybrid procedures were performed in the Ronald Reagan UCLA Medical Center adult cardiac catheterization laboratories and involved a collaboration among several UCLA departments, including cardiology, cardiac surgery, anesthesiology, radiology and operating-room administration. Pre-procedure imaging was needed, as well as critical care teams for post-surgical care.

"UCLA is a leader in utilizing these hybrid procedures to meet individual patient care needs. We hope our experiences can help move the field forward," Shivkumar said.

Shivkumar added that his team created new procedural protocols for using technologies such as electrical heart mapping systems and ablation catheters with these new hybrid procedures.

Additional authors from the UCLA Cardiac Arrhythmia Center and UCLA Division of Cardiothoracic Surgery included Dr. Yoav Michowitz, Dr. Nilesh Mathuria, Dr. Roderick Tung, Dr. Fardad Esmailian, Dr. Murray Kwon, Dr. Shiro Nakahara, Dr. Tara Bourke, Dr. Noel G. Boyle and Dr. Aman Mahajan.

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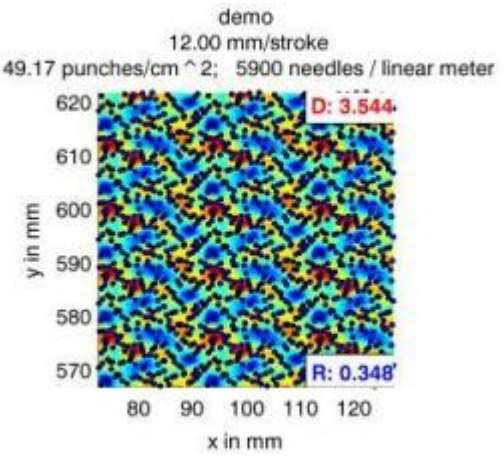
1. Yoav Michowitz, Nilesh Mathuria, Roderick Tung, Fardad Esmailian, Murray Kwon, Shiro Nakahara, Tara Bourke, Noel G. Boyle, Aman Mahajan, Kalyanam Shivkumar. **Hybrid procedures for epicardial catheter ablation of ventricular tachycardia: Value of surgical access**. *Heart Rhythm*, 2010; 7 (11): 1635 DOI: 10.1016/j.hrthm.2010.07.009

http://www.sciencedaily.com/releases/2010/11/101108140923.htm

Perfectly Needled Nonwoven



The density of the needle penetrations can be simulated using special software tools. (Credit: © Fraunhofer ITWM)

ScienceDaily (Dec. 10, 2010) — Hardly any other textile is as versatile as nonwoven: it keeps babies' bottoms dry and protects plants from the sun. In the Gulf of Mexico, special nonwovens soaked up the oil washed up on beaches like blotting paper. A new piece of simulation software now makes it possible to produce high-quality, stripe-free nonwoven fabrics.

What do diapers, wiping cloths, wall paneling, sticking plasters and Ultrasuede covers for upholstered furniture have in common? All these products are made of nonwovens. There is hardly any other fabric that is as versatile. Last summer the operators of the Zugspitze railroad even used sheets of nonwovens to prevent the snow melting away on Germany's highest mountain. The quality of this textile, however, varies considerably. It is generally true to say that the firmer, the smoother and the freer of marks the nonwoven is, the higher the quality. In the search for the perfect nonwoven, the Austrian needling machine manufacturer Oerlikon Neumag Austria asked the Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern for help.

Needling machines are essential in the production of nonwoven fabrics: "Nonwovens are bonded mechanically by needling. The needles punch vertically in and out of the material. The machine then transports the material and the needles come down again. This process locks the fibers together," explains Dr. Simone Gramsch, a scientist at the ITWM. "The needle penetrations have to be completely even, otherwise unwanted marks such as longitudinal, diagonal or transverse stripes occur, and the material is less tear-resistant," says Gramsch. Oerlikon Neumag Austria used to conduct the needling process without computer simulations. The needles were arranged manually based on past experience, and the needle boards constructed and tested by trial and error an approach that took several months and cost a lot of money. The research scientist and her team have managed to cut the time needed for this process significantly. There will no longer be a need for practical tests: Using software tools they themselves developed, the scientists have been able to simulate the needle penetration geometry, allowing them to optimize the needle patterns.

The strength and stretch characteristics of the nonwoven fabric are affected not only by the arrangement of the needles but also by their penetration density. The draft and the feed per stroke have to be coordinated as well. "Our software takes all these factors into account. We simulate and assess the penetration pattern according to the parameters entered. This enables the design engineer to determine where the needles are best placed on the needle board," says the scientist. Thanks to the new program, objective quality criteria now replace subjective assessment by the human eye. What's more, the experts have also programmed a design engineering tool. The user enters the feeds per stroke and the drafts for which he wants to construct a needle

board. He specifies how wide he wants the board to be and what type of needles to use. The software then automatically comes up with a suitable needle board design.

But the development of the software posed some problems for the researchers. For example, a needle board has to be able to handle various feeds, because textile manufacturers do not produce the same nonwovens with the same feeds every day. Each needle rearrangement leads to several hours of lost production, and no manufacturer can afford that. For this reason the ITWM program has to be able to design a needle board that delivers equally well needled nonwovens for several feeds per stroke. "We managed that too," beams Gramsch. Oerlikon Neumag Austria has now used the results of the software to build numerous new needle boards.

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http://www.sciencedaily.com/releases/2010/11/101108140640.htm

Your Tub or Mine

An old debate is rearing its head again.

The two primary camps of higher education budgetary strategy have for years been wrestling over whether it's better to dole out revenues from a central administration or allow individual colleges to control their own financial destinies. With an economic crisis now draining dollars from college coffers across the country, that question is yet again top of mind on several campuses.

The debate over the two models essentially boils down to whether colleges or academic units within a university should bear their own expenses and keep their share of tuition, grants and gifts – "Each Tub On Its Own Bottom," it's often said – or be given a share of resources from the central administration based on established institutional priorities.

For some scholars of higher education, it's predictable that several institutions have moved toward or considered centralized models amid the economic downturn. Cases in point include Vanderbilt University, which adopted greater budgetary centralization in the 2009-10 academic year, and Cornell University, where a task force's recommendations this year were widely viewed as a move toward more central budgetary control.

"I'm not surprised that institutions would be considering centralizing their models during periods of financial restraint, because that's happened a lot," said William Lasher, a professor emeritus of higher education at the University of Texas at Austin.

Lasher explains that centralization in tough budget times is a tacit acknowledgment among high-level administrators that – after all the committees have had their say – someone up top is going to have to make a tough call, and that's easier with more control over the purse strings from the outset.

"Ultimately, the really tough decisions are going to have to be made by the administration, because they are the guys that are paid to do that," Lasher said.

But it just wouldn't be higher education if everyone agreed on a strategy, would it? Indeed, there are plenty of voices on the other side, arguing that the best way to encourage deans to pursue new revenues on college campuses is to force them to fight for their own survival. Nothing concentrates the mind like a balance sheet with red ink.

"It is no surprise that public universities [in particular] that are watching state subsidies drop like a rock are looking for more entrepreneurship," said John Curry, managing director of Huron Consulting, who has held senior-level finance positions at the California Institute of Technology and several other institutions.

While not naming clients, Curry said he's actually working now with three public universities that are all considering a decentralized model, often dubbed "Responsibility Centered Management" or "Revenue Centered Management" (RCM). Individual academic units, such as the University of California at Los Angeles's business school, have similarly seen the economic crisis as a motivator to become more financially independent.

A number of elite institutions operate on an RCM system, and Harvard University is noted as an early adopter that is still employing an extremely decentralized budget system. But critics of an RCM model often suggest it doesn't give the central administration enough tools to underwrite strategic initiatives across multiple colleges – an increasingly common practice at major research institutions where interdisciplinary work reaps some of the greatest funding rewards. A centralized model, the theory goes, allows an institution to set or

change priorities, moving money around to suit the needs of an evolving institution. But that's not necessarily how it works in practice, Curry said. Once deans get used to a certain budget allocation, they're none too pleased to hear it's going to be reduced to fund another initiative deemed more worthy, and that can mean money doesn't move around as much as one might think.

"I have seen centralized management far more ossified than the distributed responsibility system," Curry said.

But the disciples of centralization beg to differ. Take Robert A. Brown, president of Boston University and a major proponent of the centralized model. Brown is convinced that very real downsides can come with an RCM system, saying that deans who fear losing tuition revenue when students take courses elsewhere will fight to keep them no matter what.

"It can lead to all kind of perverse incentives, like engineering schools that want to teach English," he said.

Apart from the possible pedagogical issues of teaching English in an engineering school, Brown suggests that RCM systems can encourage a duplication of efforts across colleges, which are determined to hang on to tuition dollars by teaching courses already offered elsewhere.

Brown views the panoply of courses and disciplines at Boston as one of the university's key attributes, and his allegiance to centralization is in part driven by a desire to ensure students can move freely throughout the institution. The university's One BU initiative is intimately linked to the broader goal of student mobility, and administrators are working to increase course availability and better align entry requirements across majors to ensure that can happen, Brown said.

"We're trying to break down the barriers," he said. "It's easier to do that precisely because we're not an RCM institution, so a school that loses four credits because a student goes to another college doesn't get penalized."

While Boston has been centralized for decades, Vanderbilt has only recently joined the club. The university is hoping to break down some of the same barriers Brown cites, figuring a move away from RCM – at least for four undergraduate schools – will help.

Richard C. McCarty, Vanderbilt's provost, says he remembers from his own experience as a dean how the RCM system discouraged student mobility.

"I can tell you for a fact that we as a school attempted to restrict the movement of Arts and Science students into education or music or engineering because it cost us money," says McCarty, who was dean of arts and science at Vanderbilt before moving into his current role. McCarty suggests the disincentives for students were more reflected in a governing philosophy of the colleges than actual policy barriers, but at the same time he concedes that credit hour requirements and other measures often have the favorable financial effect of keeping students grounded in a single school.

While McCarty is a critic of RCM as a provost, he actually had it pretty good in arts and science. The college teaches a host of general education courses for students majoring in other colleges, meaning a steady flow of tuition dollars coming in from colleges such as education and engineering. "Honestly, it sets up a lot of tension," McCarty says. "I think [centralization] encourages people to think more as university citizens than a school that's renting space on campus."

The jury is still out, however, on whether Vanderbilt's budget model will be viewed as equitable and whether it will accomplish broader strategic goals. Kenneth F. Galloway, dean of the school of engineering, calls the new model "a work in progress." He notes that the school has benefited from institutional funding of large-scale construction projects that it might not have been able to fund on its own.

The centralized model effectively forces academic units to make a case for their goals and plans, which can be positive, Galloway adds. At the same time, there's less control at the local level.

"There is sometimes uncertainty about how to proceed if the school wishes to support a faculty initiative but doesn't control the funding for it," Galloway wrote in an e-mail.

Cornell Grapples With New Model

Even higher education's biggest proponents concede that it is an enterprise often resistant to change, and it's little wonder that fundamental changes to budgetary strategy are among the most difficult to sell. That difficulty became apparent early this year at Cornell, where recommendations from a budget task force that seemed to argue for greater centralization received mixed reviews.

When faculty and administrators gathered to discuss the task force's recommendations in February, there was plenty of talk about winners and losers. As reported by the *Cornell Chronicle*, the university's in-house publication, some viewed a lurch toward greater administrative control as potentially deleterious. "You're essentially undoing the decentralization that has made Cornell the great institution that it is," said John Bishop, associate professor of human resource studies in the ILR School. "The provost gets the power to kill off a campus if he wants to and to do whatever he wants."

In a Friday interview, Bishop told *Inside Higher Ed* that he worried a centralized model might involve high-level administrators in decisions on hiring, which are best left to experts in their fields. Moreover, there are healthy incentives for colleges and schools to pull their own weight in a decentralized system, he said.

"If [schools] are successful, they should continue," Bishop said. "If they're not, then the provost should decide, 'I can't subsidize these guys so they are going to go down.' " The fears Bishop and others expressed have not come to fruition at Cornell, because the university hasn't adopted the task force's recommendations, said Elmira Mangum, Cornell's vice president for budget and planning. At the same time, the university is reviewing its budget policies and aiming to develop a system that is more transparent and standardized across colleges, she said.

"We're still wrestling with this on campus in terms of what we can do," she said. "It's by no means settled yet. I wish it was." Because several of Cornell's colleges are state-supported, the university's budgetary options are necessarily limited. The four state-supported colleges are statutorily obligated to retain their own tuition revenues, necessarily instilling those units with one of the hallmarks of an RCM system. At the same time, Mangum says that only the law school and the Samuel Curtis Johnson Graduate School of Management function independently as "tubs," controlling revenues and expenditures independently.

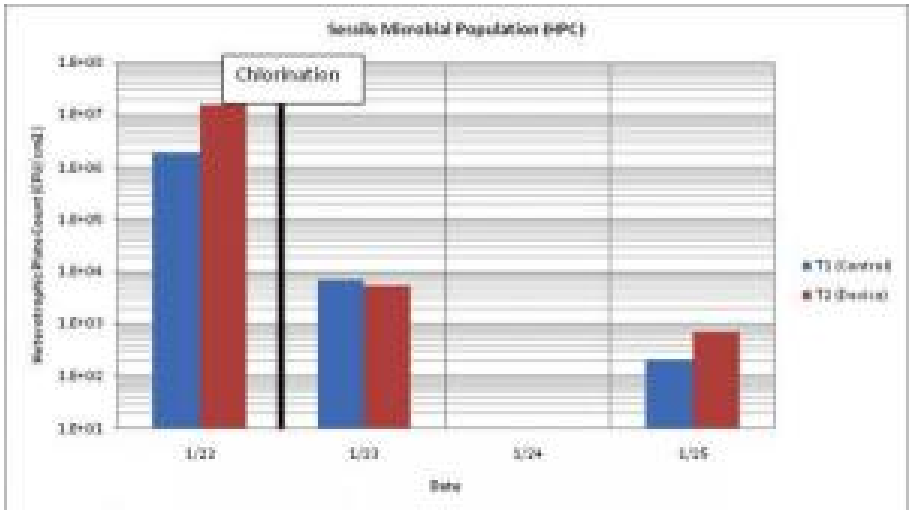
"I think what most people want to know is that they will be treated fairly, and they can understand [the budget process] and they will be accountable," Mangum said. Economic pressures, she added, are another incentive for rethinking how budgeting is done.

"I think that's probably what is [compelling] a lot of people to examine how they actually allocate their resources," she said, "and on what basis they should allocate those resources."

— Jack Stripling

http://www.insidehighered.com/news/2010/12/13/budget

'Green' Water Treatments May Not Kill Bacteria in Large Building Cooling Systems



The model cooling tower treated with the pulsed electric-field device showed no significant difference in bacteria population than the nontreated tower. After a chlorine treatment was administered, the microbial populations in both model cooling towers fell by four orders of magnitude within three days. (Credit: Image courtesy of University of Pittsburgh)

ScienceDaily (Dec. 10, 2010) — Nonchemical treatment systems are touted as environmentally conscious stand-ins for such chemicals as chlorine when it comes to cleaning the water-based air-conditioning systems found in many large buildings. But a recent study by University of Pittsburgh researchers suggests that this diverse class of water-treatment devices may be ineffective and can allow dangerous bacteria to flourish in the cooling systems of hospitals, commercial offices, and other water-cooled buildings almost as much as they do in untreated water.

The two-year study by a team in Pitt's Swanson School of Engineering is the first to thoroughly investigate the ability of nonchemical treatment devices (NCDs) to control the growth of bacteria in water-based cooling systems. Of the five NCDs tested, none significantly prevented bacterial growth. On the other hand, the researchers found that standard chlorine treatment controlled these organisms, even after bacteria had been allowed to proliferate.

"Our results suggest that equipment operators, building owners, and engineers should monitor systems that rely on NCDs to control microorganisms," saidcoinvestigator Janet Stout, a research associate in the Swanson School's Department of Civil and Environmental Engineering and director of the Pittsburgh-based Special Pathogens Laboratory. Stout worked with fellow lead investigator Radisav Vidic, chair and William Kepler Whiteford Professor of civil and environmental engineering, and Pitt civil engineering graduate student Scott Duda.

"These cooling systems are energy efficient and, if properly treated, very safe," Stout continued. "But based on our results, nonchemical devices alone may not be enough to control microbial growth. One possible measure is to add chemical treatment as needed to prevent a potential health hazard."

The air systems the team investigated work by piping chilled water throughout a building. The water warms as it exchanges temperature with the surrounding air and becomes a hotbed of microorganisms before returning to a central cooling tower to be cleaned and re-chilled.

If the returning water is not thoroughly cleaned, bacteria can spread throughout the system, exposing people within the building to possible infection and hampering the system's energy efficiency.

The team constructed two scale models of typical cooling towers. One model remained untreated while the other was treated with five commercially available NCDs installed according to the manufacturers' guidelines. Each device was tested for four weeks. Chlorine was administered three times during the study to demonstrate that an industry-accepted chemical treatment could kill bacteria even in a heavily contaminated system.

The five devices tested represent different classes of NCDs, Vidic said. Pulsed electric-field devices emit electromagnetic energy that, in theory, ruptures bacterial membranes and activates particles that ensnare the bacterium. Electrostatic devices function similarly by producing a constant static field.

Ultrasonic devices pass a mixture of untreated water and high-pressure air through a chamber that purportedly disintegrates the bacterium with sound waves.

For hydrodynamic cavitation devices, two cone-shaped water streams collide to form a vacuum region filled with high-friction bubbles that collide with and presumably deactivate the bacteria. Finally, the team tested a magnetic device, although magnetic NCDs are intended to prevent mineral buildup, not control bacterial growth.

The study was funded by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

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http://www.sciencedaily.com/releases/2010/12/101210154530.htm

Iron Legacy Leaves Soil High in Manganese

The Shale Hills Critical Zone Observatory, part of the Critical Zone Exploration Network, is a small watershed located in Huntingdon County, Pa. (Credit: Elizebeth Herndon)

ScienceDaily (Dec. 10, 2010) — Iron furnaces that once dotted central Pennsylvania may have left a legacy of manganese enriched soils, according to Penn State geoscientists. This manganese can be toxic to trees, especially sugar maples, and other vegetation.

The research, which quantified the amounts of manganese in soil core samples, was part of work done at the Shale Hills Critical Zone Observatory funded by the National Science Foundation.

"Our group's focus was to study the soil chemistry," said Elizabeth M. Herndon, graduate student in geosciences. "We saw excess manganese in the soil and decided that we needed to quantify the manganese and determine where it came from."

Typically, manganese in soils comes from the disintegration of the bedrock as soil forms. Bedrock in this area is shale and the average amount of manganese in the shale is about 800 parts per million. However, the researchers found 14,000 parts per million of manganese in some of the soil samples. This is more than 17 times as much manganese as in the bedrock.

The researchers sampled 21 sites along a ridge at Shale Hills. They took core samples from the surface down to bedrock. At 20 of the sites they found elevated manganese. The core samples, which are about 12 inches long, encompass about 7,000 years of soil formation.

"We needed to quantify how much extra manganese there actually was in the samples," said Herndon. "While soil formation puts manganese into the soil, chemical weathering and physical erosion remove manganese from the soil, so we used a mass balance model to account for these inputs and outputs."

The researchers found that "53 percent of manganese in ridge soils can be attributed to atmospheric deposition from anthropogenic sources." They reported their results online in *Environmental Science and Technology*.

"Because the amount of manganese in the soil was highest near the surface, the added manganese was very likely industrial pollution," said Herndon.

This area of central Pennsylvania was the site of numerous iron furnaces beginning in the late 1700s. While some furnaces stayed in operation into the 20th century, most were abandoned by the 1860s. The legacy of the ores and fuels they burned remained behind in the soil.

Although the researchers, who include Herndon, Lixin Jin, postdoctoral fellow in geosciences, and Susan L. Brantley, professor of geosciences and director of the Penn State Earth and Environmental Systems Institute, knew there was added manganese, they needed to show that the element came from industry. They looked at a location near a steel mill in Burnham, in Mifflin County and found a similar pattern of manganese concentrations in the soil suggesting that the steel mill was the source of the manganese.

They also examined datasets for soils across the United States and Europe and found that a majority of these soils have excess manganese. This may indicate that manganese pollution is not just a local phenomenon but could be widespread throughout industrialized areas.

Because manganese is naturally found in soils and is readily taken up and cycled by trees, the researchers looked to see if the pattern of manganese deposition matched that of areas where trees were manipulating the manganese. In those cases, trees move manganese from deep in the soil creating deficits near the bedrock, but concentrate the manganese nearer the surface. According to Herndon, the manganese pattern did not show a depletion near bedrock and the case for industrial pollution was strengthened.

Manganese is an exceptionally reactive element and is considered toxic if inhaled, but its presence in the soil, where it occurs naturally and is less likely to be inhaled, is not typically a danger to humans. Trees, however, may be adversely effected. While sugar maples can be detrimentally affected if they have a manganese deficiency, too much manganese can be toxic especially for saplings. High levels of manganese can also damage other vegetation and crops.

"Manganese oxides could also change the chemical properties of the soil," said Herndon. "Even if the sources of manganese pollution are no longer active, the remnants remain in the soil. I find it interesting that we have to consider the kinds of contamination left over from the past that might impact us today."

The National Science Foundation supported this work.

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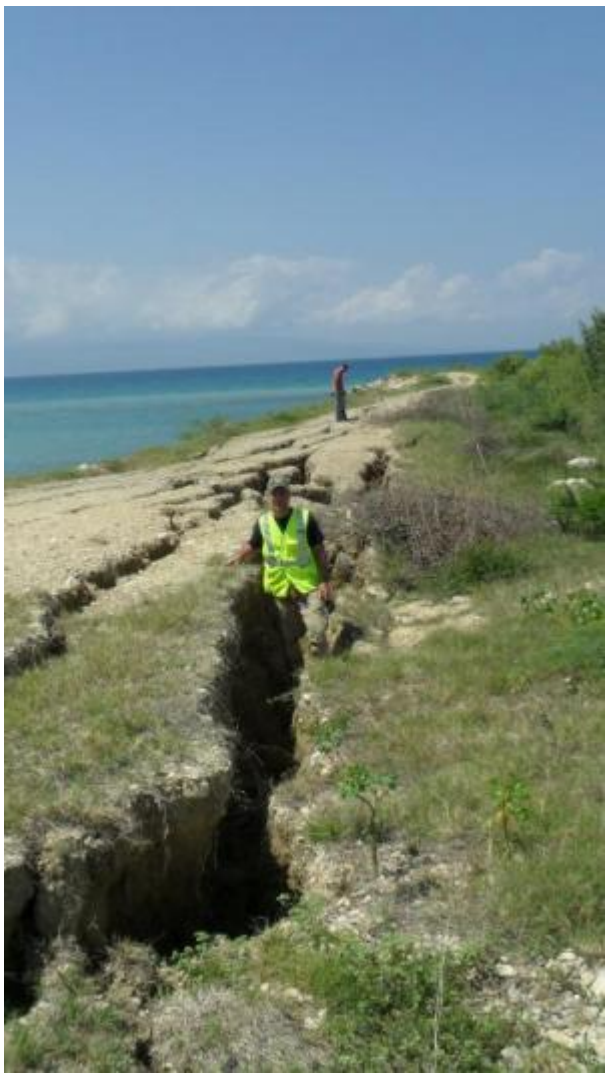
Assessing the Seismic Hazard of the Central Eastern United States



Virginia Tech associate professor of civil and environmental engineering Russell Green focuses on the study of paleoseismology to achieve a greater understanding of the probability of seismic events. (Credit: Provided by Virginia Tech)

ScienceDaily (Dec. 10, 2010) — As the U.S. policy makers renew emphasis on the use of nuclear energy in their efforts to reduce the country's oil dependence, other factors come into play. One concern of paramount importance is the seismic hazard at the site where nuclear reactors are located.

Russell A. Green, associate professor of civil and environmental engineering at Virginia Tech, spent five years as an earthquake engineer for the U.S. Defense Nuclear Facilities Safety Board in Washington, D.C., prior to becoming a university professor. Part of his responsibility at the safety board was to perform seismic safety analyses on the nation's defense nuclear facilities.

"I found the greatest uncertainty in seismic analyses was related to the ground motions used in the analyses…Many of the facilities being analyzed were already built and operating, and the facilities were already heavily contaminated with radioactive material," Green said.

An immediate concern then became how and which buildings to retrofit. The balance in the decision-making process was between using overly conservative ground motions and potentially wasting "hundreds of millions of dollars in unnecessary retrofits" versus using less demanding motions and potentially "placing facility workers, neighboring towns, and cities at risk," Green added.

Green's concerns and expertise in earthquake engineering earned him a National Science Foundation CAREER Award in 2006 valued at more than $400,000. He has used this support for the development of procedures for collecting and analyzing data required for assessing the seismic hazard in regions where moderate to large earthquakes would have significant consequences, yet they remain low probability events.

Green said a "huge shift" in the engineering profession's approach to reducing seismic risk has occurred during the past decade. Building codes have been modified to include performance-based earthquake engineering (PBEE) concepts. This differs from the previous traditional design approach that used "life safety as the primary design goal," Green explained. "PBEE is based on the premise that performance can be predicted and evaluated with quantifiable confidence, allowing the engineer, together with the client, to make intelligent and informed trade-offs based on life-cycle considerations rather than construction costs alone."

To implement PBEE and to calculate the annual probability of specific losses due to seismic events, engineers need to know the fragility of structural systems and the probabilistically quantified seismic hazard.

To conduct his research, Green is focusing on paleoseismology, the study of the timing, location, and size of prehistoric/pre-instrumental earthquakes, ranging from those that occurred hundreds to tens of thousands of years ago.

"I believe that earthquake engineering encompasses geology, seismology, geotechnical engineering, structural engineering, urban planning, and emergency response, " Green said.

"The appropriate selection of ground motions is particularly difficult because many critical facilities are located in the central and eastern U.S. and in the Pacific Northwest," Green said. "We know moderate to large earthquakes have occurred in these regions. We just do not know how large the events were, how often they occurred, or the characteristics of the associated ground shaking, such as duration, amplitude, and frequency content."

Unlike many places in the western U.S. where excavations can be used to determine the past movement on earthquake faults, in the central-eastern U.S. the locations of most faults are unknown and/or the faults are too deep to excavate. As a result, Green is concentrating his work on the development and validation of paleoliquefaction procedures. Soil liquefaction is the transition of soil from a solid to a liquefied state. Earthquakes are one cause of liquefaction, with the evidence of liquefaction often remaining in the soil profile for many thousands of years after the earthquake.

"Paleoliquefaction investigations are the most plausible way to determine the recurrence time of moderate to large earthquakes in the central-eastern U.S. ," Green said. "By extending the earthquake record into prehistoric times, paleoseismic investigations remove one of the major obstacles to implementing PBEE across the U.S."

To determine the age of a paleoliquefaction feature, researchers might use any one of a number of techniques, including: radiocarbon dating, optically stimulated luminescence, or archeological evidence.

Green said his work will address the "gaps in knowledge that typically stem from uncertainties related to analytical techniques used in back-calculations, the amount and quantity of paleoliquefaction data, and the significance of changes in the geotechnical properties of post-liquefied sediments such as aging and density changes."

In addition to his work studying paleoearthquakes, Green has also been involved in performing field studies of several recent earthquakes. He has performed post-earthquake field studies of the 2008 Mt. Carmel, Ill., magnitude 5.2 earthquake, the 2008 Iwate Miyagi-Nairiku, Japan, magnitude 6.9 earthquake, the 2010 Haiti, magnitude 7.0 earthquake, and the 2010 Darfield, New Zealand, magnitude 7.1 earthquake. The latter two field studies were National Science Foundation sponsored Geo-Engineering Extremes Events Reconnaissance (GEER) investigations, with Green serving as the US Team leader for the Darfield earthquake study.

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Story Source:

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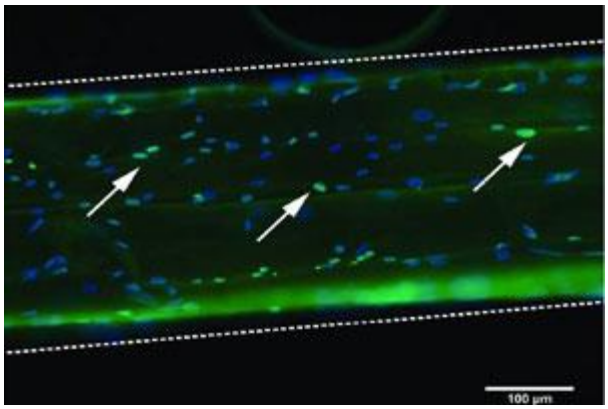
http://www.sciencedaily.com/releases/2010/12/101210100904.htm

Stem Cells: A 'Stitch in Time' Could Help Damaged Hearts



The cells on a single microthread. The cells in green are in the process of dividing. (Credit: Image courtesy of Worcester Polytechnic Institute)

ScienceDaily (Dec. 9, 2010) — A research team at Worcester Polytechnic Institute (WPI) has demonstrated the feasibility of a novel technology that a surgeon could use to deliver stem cells to targeted areas ofthe body to repair diseased or damaged tissue, including cardiac muscle damaged by a heart attack. The technique involves bundling biopolymer microthreads into biological sutures and seeding the sutures with stem cells. The team has shown that the adult bone-marrow-derived stem cells will multiply while attached to the threads and retain their ability to differentiate and grow into other cell types.

The results are reported in the the *Journal of Biomedical Materials Research.*

"We're pleased with the progress of this work," said Glenn Gaudette, assistant professor of biomedical engineering at WPI and lead author on the paper. "This technology is developing into a potentially powerful system for delivering therapeutic cells right to where they are needed, whether that's a damaged heart or other tissues."

Gaudette's lab is focused on cardiac function, exploring ways to heal damaged heart muscle and to develop cell-based methods to treat cardiac arrhythmias. Much of this work uses human mesenchymal stem cells (hMSCs), which come from the bone marrow and can grow into a range of other tissues in the body, including muscle, bone, and fat. Studies by Gaudette and others have shown that when hMSCs are delivered to damaged hearts, they moderately improve cardiac function. A major challenge in these studies, however, is getting sufficient numbers of the hMSCs to engraft into the damaged heart tissue. Prior methods of injecting the cells into the bloodstream, or directly into the heart muscle, have yielded low results, with 15 percent or less of the cells injected actually surviving and attaching to the heart muscle. Most of the hMSCs delivered by injection are washed away by the bloodstream.

To address the delivery problem, Gaudette teamed up with colleague George Pins, associate professor of biomedical engineering at WPI, who has developed the biopolymer microthread technology as a "scaffold" or a temporary structure to use in various applications of wound-healing and cellular therapy. The microthreads, which are about the thickness of a human hair, are made of fibrin, a protein that helps blood clot. The threads can be engineered to have different tensile strengths and to dissolve at different rates once implanted so they can be fine-tuned for a variety of uses. Pins is exploring the use of threads to produce replacement tendons and ligaments. Ray Page, assistant professor of biomedical engineering at WPI, leads a team using the microthreads as a platform for fibroblasts to induce skeletal muscle regeneration.

In the current study, Gaudette's team developed protocols to seed hMSCs on small bundles of the fibrin microthreads. Once the stem cells attached to the threads, they were cultured for five days and the data showed the cells began to multiply until the two-centimeter-long threads were virtually covered, with nearly 10,000 cells hMSCs on each one. After the seeding and growing process, Gaudette's team attached the microthreads to a surgical needle and drew them through a collagen gel made to simulate human tissue. When the threads were drawn through the gel, the vast majority of the stem cells remained alive and attached to threads, suggesting they could be sutured into human tissue.

Gaudette's team also examined the hMSCs that had grown on the threads to see if they remained multipotent, meaning they retain the ability to grow into other types of cells. They removed the hMSCs from the threads and cultured them via established protocols known to prompt hMSCs to differentiate into fat cells and bones cells. In both cases, the cells taken from the microthreads began to differentiate along the pathways that lead to fat and bone tissue. "It appears that the cells we grew on the threads behave the same way we would expect mesenchymal stem cells would in vivo," Gaudette said. "So we believe these results are proof-of-principle -- that we can now deliver these cells anywhere a surgeon can place a suture. That's exciting."

Gaudette's team is already at work on the next steps in this line of research, testing the stem cell-seeded microthreads in a rat model to see if they can engraft into heart tissue and improve cardiac function.

The research reported in the current study was funded by the National Institutes of Health.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Worcester Polytechnic Institute**.

Journal Reference:

1. Megan K. Proulx, Shawn P. Carey, Lisa M. Ditroia, Craig M. Jones, Michael Fakharzadeh, Jacques P. Guyette, Amanda L. Clement, Robert G. Orr, Marsha W. Rolle, George D. Pins, Glenn R. Gaudette. **Fibrin microthreads support mesenchymal stem cell growth while maintaining differentiation potential**. *Journal of Biomedical Materials Research*, 29 Nov 2010 DOI: 10.1002/jbm.a.32978

http://www.sciencedaily.com/releases/2010/12/101209113546.htm

Elusive Spintronics Success Could Lead to Single Chip for Processing and Memory

Dr Alan Drew. (Credit: Image courtesy of Queen Mary, University of London)

ScienceDaily (Dec. 9, 2010) — Researchers from Queen Mary, University of London (UK) and the University of Fribourg (Switzerland) have shown that a magnetically polarised current can be manipulated by electric fields.

Published this week in the journal *Nature Materials*, this important discovery opens up the prospect of simultaneously processing and storing data on electrons held in the molecular structure of computer chips -- combining computer memory and processing power on the same chip.

"This is especially exciting, as this discovery has been made with flexible organic semiconductors, which are set to be the new generation of displays for mobile devices, TVs and computer monitors, and could offer a step-change in power efficiency and reduced weight of these devices," said Dr Alan Drew, from Queen Mary's School of Physics, who led the research.

'Spintronics' -- spin transport electronics -- has rapidly become the universally used technology for computer hard disks. Designed in thin layers of magnetic and non-magnetic materials, Giant Magnetoresistive (GMR) spin valves use the magnetic properties, or 'spin', of electrons to detect computer data stored in magnetic bits. In contrast, computer processing relies on streams of electrically charged electrons flowing around a tiny circuit etched into a microchip.

Dr Drew and his team have investigated how layers of Lithium Fluoride (LiF) -- a material that has an intrinsic electric field -- can modify the spin of electrons transported through these spin valves. He explains: "While in theory, devices that combine electron charge and spin are conceptually straightforward, this is the first time anybody has shown it is possible to proactively control spin with electric fields."

Professor Christian Bernhard, from the University of Fribourg Physics Department, describes their successful technique: "Using the direct spectroscopic technique Low Energy Muon Spin Rotation (LE-μSR), our experiments have visualised the extracted spin polarisation close to buried interfaces of a spin valve."

The experiments were performed at the Paul Scherrer Institute, the only institution worldwide; where this technique is available. The method employs the magnetic properties of muons -- unstable subatomic particles. "In such an experiment the muons are shot into the material and when they decay, the decay products carry

information about the magnetic processes inside the material," explains Professor Elvezio Morenzoni from PSI, where the technique has been developed. "The unique thing about low energy muons is that they can be placed specifically in a particular layer of a multi-layer system. Thus using this method one can study the magnetism in any single layer separately."

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

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

Journal Reference:

1. L. Schulz, L. Nuccio, M. Willis, P. Desai, P. Shakya, T. Kreouzis, V. K. Malik, C. Bernhard, F. L. Pratt, N. A. Morley, A. Suter, G. J. Nieuwenhuys, T. Prokscha, E. Morenzoni, W. P. Gillin, A. J. Drew. **Engineering spin propagation across a hybrid organic/inorganic interface using a polar layer**. *Nature Materials*, 2010; DOI: 10.1038/nmat2912

http://www.sciencedaily.com/releases/2010/12/101208130052.htm

Greenland Ice Sheet Flow Driven by Short-Term Weather Extremes, Not Gradual Warming, Research Reveals

Icebergs off the Greenland coast. (Credit: iStockphoto/Robert Becker)

ScienceDaily (Dec. 9, 2010) — Sudden changes in the volume of meltwater contribute more to the acceleration -- and eventual loss -- of the Greenland ice sheet than the gradual increase of temperature, according to a University of British Columbia study.

The ice sheet consists of layers of compressed snow and covers roughly 80 per cent of the surface of Greenland. Since the 1990s, it has been documented to be losing approximately 100 billion tonnes of ice per year -- a process that most scientists agree is accelerating, but has been poorly understood. Some of the loss has been attributed to accelerated glacier flow towards ocean outlets.

Now a new study, published in the journal *Nature*, shows that a steady meltwater supply from gradual warming may in fact slow down glacier flow, while sudden water input could cause glaciers to speed up and spread, resulting in increased melt.

"The conventional view has been that meltwater permeates the ice from the surface and pools under the base of the ice sheet," says Christian Schoof, an assistant professor at UBC's Department of Earth and Ocean Sciences and the study's author. "This water then serves as a lubricant between the glacier and the earth underneath it, allowing the glacier to shift to lower, warmer altitudes where more melt would occur."

Noting observations that during heavy rainfall, higher water pressure is required to force drainage along the base of the ice, Schoof created computer models that account for the complex fluid dynamics occurring at the interface of glacier and bedrock. He found that a steady supply of meltwater is well accommodated and drained through water channels that form under the glacier.

"Sudden water input caused by short term extremes -- such as massive rain storms or the draining of a surface lake -- however, cannot easily be accommodated by existing channels. This allows it to pool and lubricate the bottom of the glaciers and accelerate ice loss," says Schoof, who holds a Canada Research Chair in Global Process Modeling.

"This certainly doesn't mitigate the issue of global warming, but it does mean that we need to expand our understanding of what's behind the massive ice loss we're worried about," says Schoof.

A steady increase of temperature and short-term extreme weather conditions have both been attributed to global climate change. According to the European Environment Agency, ice loss from the Greenland ice sheet has contributed to global sea-level rise at 0.14 to 0.28 millimetres per year between 1993 and 2003.

"This study provides an elegant solution to one of the two key ice sheet instability problems identified by the Intergovernmental Panel on Climate Change in their 2007 assessment report," says Prof. Andrew Shepherd, an expert on using satellites to study physical processes of Earth's climate, based at the University of Leeds, the U.K.

"It turns out that, contrary to popular belief, Greenland ice sheet flow might not be accelerated by increased melting after all," says Shepherd, who was not involved in the research or peer review of the paper.

The research was supported by the Canada Research Chairs Program, the Natural Sciences and Engineering Research Council of Canada, and the Canadian Foundation for Climate and Atmospheric Sciences through the Polar Climate Stability Network.

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Story Source:

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

Journal Reference:

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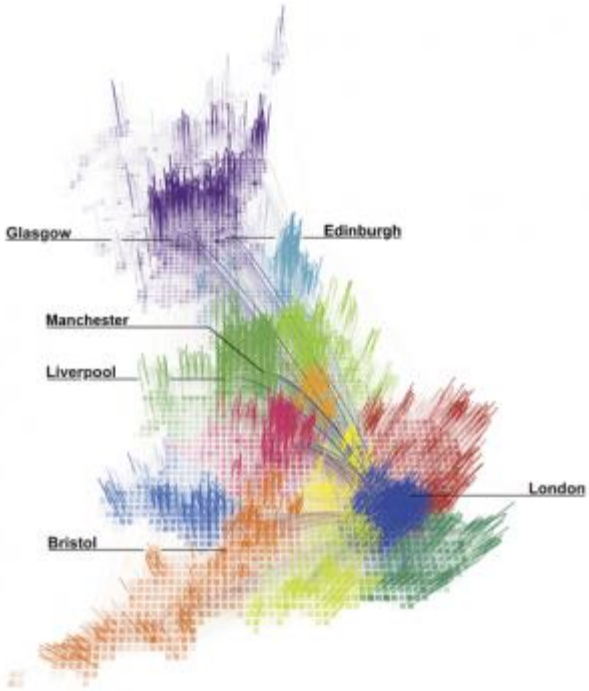
http://www.sciencedaily.com/releases/2010/12/101208172318.htm

Redrawing the Map of Great Britain Based on Human Interaction



The geography of talk in Great Britain: This figure shows the strongest 80% of links, as measured by total talk time, between areas within Britain. The opacity of each link is proportional to the total call time between two areas and the different colours represent regions identified using network modularity optimisation analysis. (Credit: Carlo Ratti, Stanislav Sobolevsky, Francesco Calabrese, Clio Andris, Jonathan Reades, Mauro Martino, Rob Claxton, Steven H. Strogatz. Redrawing the Map of Great Britain from a Network of Human Interactions. PLoS ONE, 2010; 5 (12): e14248 DOI: 10.1371/journal.pone.0014248)

ScienceDaily (Dec. 9, 2010) — A group of researchers at MIT, Cornell University and University College London have used one of the world's largest databases of telecommunications records to redraw the map of Great Britain. The research, which will be published in the journal *PLoS ONE* on Dec. 8, is based on the analysis of 12 billion anonymized records representing more than 95% of Great Britain's residential and business landlines.

"Since the pioneering work of Christaller and Lösch in the early 20th century, a long-standing question in economic geography has been how to define regions in space," explains Carlo Ratti, director of the MIT SENSEable City Lab and one of the paper's authors. "Our paper proposes a novel, fine-grained approach to regional delineation, based on analyzing networks of billions of individual human transactions."

Given a geographical area and some measure of the strength of links between its inhabitants, the paper describes mathematically how to partition the area into smaller, non-overlapping regions while minimizing the disruption to each person's links. For the most part, the results of the partitioning correspond remarkably well with existing administrative regions, but they still unveil some unexpected spatial structures.

"We have discovered a new region just west of London which corroborates an earlier hypothesis of a 'western crescent' centered on high-tech activities," explains the Francesco Calabrese, one of the paper's authors. Wales, and to a lesser extent Yorkshire, also seem to have been incorporated into regions dominated by the major cities of the West and East Midlands regions, respectively.

"The difference between Scotland and Wales is striking," adds Ratti. "Based on our landline data, Scotland is very separated from the rest of Great Britain: just 23.3% of all call time placed or received there goes to or comes from another part of the country. Conversely, Wales, in spite of its unique cultural and linguistic heritage, is well integrated with its English neighbors to the East."

It's unlikely, of course, that Wales and England are going to merge anytime soon, so the discovery that several Welsh cities seem to depend heavily on the exchange of information with nearby English cities, and vice versa, probably won't have major political consequences. But, Ratti says, the value of the new work is that it shows that analyzing information flow could be a useful tool in the drawing of political boundaries. And, he says, it will only become more useful as data from other networks -- the Internet, Internet telephone networks, instant-messaging networks -- become available for analysis.

The paper's approach belongs to an emerging field that has been recently termed "computational social sciences" -- i.e., the ability to address social-science research questions using huge datasets that have emerged over the past decades as a result of digitalization. "We are particularly interested in how rich data at the individual level can promote a better understanding of our society, which, in the future, could lead to more democratic, bottom-up structures of governance," adds Calabrese.

"Very little in network theory has been done, believe it or not, on networks in geographical Euclidean space," says coauthor Professor Steven Strogatz, one of the pioneers of network science. "In reality, on top of the pure topology of who is connected to whom is the structure of actual distances. I think that the analysis of spatial networks, as in this paper, could be a really important area in the next few years."

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Story Source:

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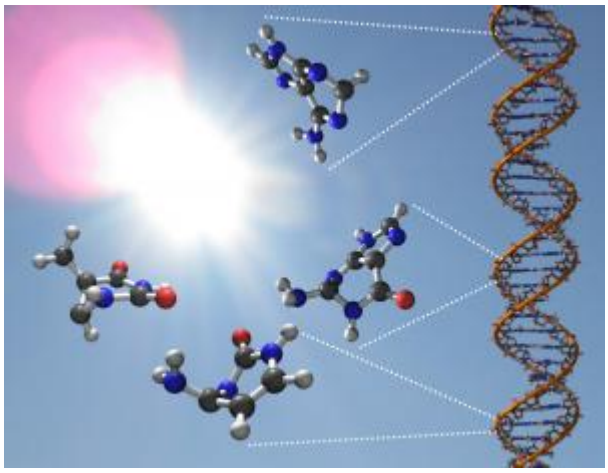
Journal Reference:

1. Carlo Ratti, Stanislav Sobolevsky, Francesco Calabrese, Clio Andris, Jonathan Reades, Mauro Martino, Rob Claxton, Steven H. Strogatz. **Redrawing the Map of Great Britain from a Network of Human Interactions**. *PLoS ONE*, 2010; 5 (12): e14248 DOI: 10.1371/journal.pone.0014248

http://www.sciencedaily.com/releases/2010/12/101208172316.htm

How Do DNA Components Resist Damaging UV Exposure?



The figure shows the special structures of DNA nucleobases, which – after exposure to solar radiation – are responsible for the ultrafast radiationless deactivation to the electronic ground state. (Credit: Felix Plasser, University of Vienna)

ScienceDaily (Dec. 9, 2010) — The genetic material of DNA contains shielding mechanisms to protect itself from the exposure to the UV light emitted by the sun. This is of crucial importance, since without photostability -- i.e. without "programmed" defense mechanisms against UV irradiation -- there would be a rapid degradation of DNA and RNA.

As part of a project funded by the Austrian Science Fund (FWF) a group of researchers led by Hans Lischka, Quantum Chemist of the University of Vienna, Austria, could, for the first time, comprehensively unravel these ultra-fast processes of the photostability of the nucleobases.

The effect of sunlight on our skin not only leads to tanning, but it also initiates processes that can lead to serious health damage. A research team led by Hans Lischka, Professor at the Institute for Theoretical Chemistry, University of Vienna, Austria, investigated the shielding mechanisms that nature has provided to protect itself against such harmful effects. The strategy here is simple, yet highly complex: As soon as the UV light excites the electrons into a higher energy level, ultra-fast decay brings them back to its original state. In this way electronic energy is converted into heat. This process occurs in an incredibly short amount of time, in up to a quadrillionth of a second.

Computer simulations on the properties of light-active DNA components

In the group of Hans Lischka (Institute for Theoretical Chemistry, University of Vienna), together with Mario Barbatti (now Max-Planck-Institut for coal research, Mülheim/Ruhr, Germany) and in collaboration with colleagues of the Czech Academy of Sciences in Prague, Czech Republic, a vivid dynamic picture of the photostability of the nucleobases was given using innovative computer simulation techniques. It could be shown how the DNA components -- the nucleotides that are responsible in DNA and RNA for the formation of base pairs -- protect themselves against decomposition under UV irradiation.

New Quantum Chemical approaches for photophysical studies

The principal innovation of this work consists in the detailed calculation of the coupling of the electronic dynamics with that of the atomic nuclei. This goal was achieved with the help of worldwide unique quantum chemical methods developed at the Institute for Theoretical Chemistry, University of Vienna. The calculated

states of motion of the nucleobases show a quite remarkable dynamic behavior in time that spans several orders of magnitude -- from the pico/trillionth to the femto/quadrillionth-second range.

The newly developed methods are suitable not only for elucidation of the above-described dynamics in DNA nucleobases, but they are also applicable to studies of photo-physical processes in DNA itself and in the area of photovoltaics which is of high technological interest. The new methods allow a better understanding of the fundamental processes of transport of electronic excitation energy and of charge separation for production of electricity.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

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

Journal Reference:

1. Mario Barbatti, Adélia J. A. Aquino, Jaroslaw J. Szymczak, Dana Nachtigallová, Pavel Hobza, and Hans Lischka. **Relaxation mechanisms of UV-photoexcited DNA and RNA nucleobases**. *Proceedings of the National Academy of Sciences*, DOI: 10.1073/pnas.1014982107

http://www.sciencedaily.com/releases/2010/11/101130103829.htm

Fledgling Ecosystem in Former Open-Pit Coal Mine in Germany Lets Scientists Observe How Soil, Flora and Fauna Develop

Researchers from the Technische Universitaet Muenchen and other institutions are studying the development of a fledgling ecosystem at a site called Huehnerwasser or "Chicken Creek." In a former open-pit coal mining area of Brandenburg, Germany, scientists partitioned off a surface of six hectares and left nature to its own resources. They are closely observing soil, flora, and fauna to determine what factors have a particularly strong influence on developing ecosystems. (Credit: Michael Elmer, BTU Cottbus)

ScienceDaily (Dec. 9, 2010) — How do ecosystems develop? No one really knows, yet. There is however one project, unique in the world, seeking to answer this question. In a former open-pit coal mining area in Brandenburg, Germany, a surface of six hectares was partitioned off and then left to its own resources. Scientists from the Technische Universitaet Muenchen (TUM), in collaboration with researchers from other institutions, are studying the development of soil, flora, and fauna there. With this research they aim to establish the factors that have a particularly strong influence on developing ecosystems.

Young ecosystems are rare. They can be found, for instance, when ice from thawing glaciers releases the pristine debris it transports -- as is currently the case with the Damma Glacier in the Swiss Alps. In general, though, we are surrounded by age-old ecosystems that have developed over millions of years and whose interactions and structures are well established. Such systems are, for instance, rain forests, deserts, or seas. Scientists do not know much yet about how these systems develop. The geochemical and biological processes that occur during development are for the most part well understood. It is not yet clear, though, how and when they occur and what influences them. In order to unveil nature's secrets, scientists from TUM are participating in an international interdisciplinary project.

To this end, BTU Cottbus constructed a special research area, unique in the world. It is located in a former open-pit coal mining region south of Cottbus and bears the name of a creek that used to flow through there:

Huehnerwasser, or Chicken Creek. Regional sediment originating from the ice age was re-deposited, graded, and fenced off over an area larger than six football fields. A protective layer of clay was laid out at a depth of several meters to capture percolating rainwater and direct it toward an artificial spring flowing into a pond. No fertilizer was used, not a single seed planted, no organism artificially cultivated there. Since its completion in the fall of 2005, the world's largest artificial water catchment area has been developing autonomously. It is being meticulously observed, though. As if in an open air laboratory, the BTU Cottbus, the ETH Zurich, and other non-academic partners have been conducting research together with the Technische Universitaet Muenchen on this project since 2007.

TUM researchers are looking into this area from various perspectives. Plant ecologists checked the initial state of the seed reservoir in the soil and are now observing the development of the vegetation, i.e. which plant species settle in the soil, in what order, and where their seeds come from. Forest growth researchers are studying the surface structures. For instance, they regularly measure the changes in soil surface and vegetation. Their goal is to generate a mathematical model that can simulate the dynamic interaction between vegetation and surface development. Soil ecologists look into the soil. They analyze time and again the number and species of microorganisms living in the soil to establish how, over the years, complex microbial communities develop in the soil at Chicken Creek, and why their composition and activity change as the seasons pass.

Professor Ingrid Koegel-Knabner and her team from the TUM Chair for Soil Science are investigating soil development from a different perspective. Their research focuses primarily on humus formation, i.e. the transformation of dead plant material into valuable, nutrient-rich soil. The researchers regularly examine the composition of soil samples in order to study the processes taking place during this initial humus formation stage. Initial results are surprising -- soil development and plant colonization at Chicken Creek are progressing more rapidly than originally assumed. "After only five years we see the first trees -- robinias," Koegel-Knabner marvels. "We weren't expecting that in under 20 years. This probably also means that a forest will grow more quickly than expected."

The most important hypothesis of the project is that the starting phase of an ecosystem is decisive. Ingrid Koegel-Knabner: "We don't know yet how long this initial phase takes. But we assume that it influences the entire subsequent development and, therefore, defines the later ecosystem at the outset." Yet what are the prevalent factors that influence the initial phase? It has already become clear that rain is one of these factors. At the very beginning a cloudburst created furrows at the site of the experiment, where water had run off and washed away the soil. The next rain also ran off through these furrows -- they became deeper and wider. That is how the first downpour determined the subsequent course of water flow and thus the locations of the plants.

What other factors play a role in the development could become clear within just a few years. The project is set to run over twelve years altogether. This might sound like a relatively long time; however, in the development time scale of an ecosystem this is practically one instant. Nevertheless, the scientists hope to gain fundamental insights into the initial stages of ecosystem development, which can later be used for targeted intervention into man-made landscapes -- for their re-naturation or re-cultivation.

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Story Source:

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

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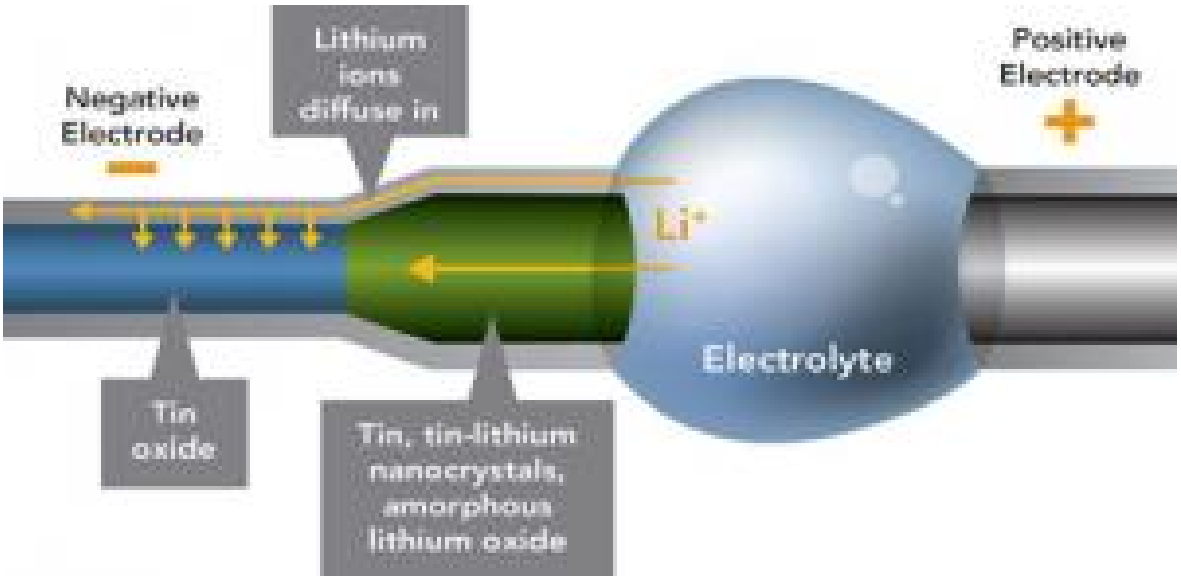
http://www.sciencedaily.com/releases/2010/12/101206135420.htm

Contorting Batteries: Charging Makes Nano-Sized Electrodes Swell, Elongate and Spiral



This nano-sized battery reveals how positive lithium ions flood the negative electrode (blue), changing the size, shape and nature of the material (the green part of the electrode). Some rechargeable materials might be more resilient than others to the repeated shape-changing. (Credit: DOE/PNNL)

ScienceDaily (Dec. 9, 2010) — New high resolution images of electrode wires made from materials used in rechargeable lithium ion batteries shows them contorting as they become charged with electricity. The thin, nano-sized wires writhe and fatten as lithium ions flow in during charging, according to a paper in this week's issue of the journal *Science*. The work suggests how rechargeable batteries eventually give out and might offer insights for building better batteries.

Battery developers know that recharging and using lithium batteries over and over damages the electrode materials, but these images at nanometer scale offer a real-life glimpse into how. Thin wires of tin oxide, which serve as the negative electrode, fatten by a third and stretch twice as long due to lithium ions coursing in. In addition, the lithium ions change the tin oxide from a neatly arranged crystal to an amorphous glassy material.

"Nanowires of tin oxide were able to withstand the deformations associated with electrical flow better than bulk tin oxide, which is a brittle ceramic," said Chongmin Wang, a materials scientist at the Department of Energy's Pacific Northwest National Laboratory. "It reminds me of making a rope from steel -- you wind together thinner wires rather than making one thick rope."

In one of the videos, shown here <http://mt.seas.upenn.edu/Stuff/JianyuHuang/Upload/S1.mov>, the nanowire appears like a straw, while the lithium ions seem like a beverage being sucked up through it. Repeated shape changes could damage the electrode materials by introducing tiny defects that accumulate over time.

Chasing Electrons

In previous work at DOE's Environmental Molecular Sciences Laboratory on the PNNL campus, Wang, PNNL chemist Wu Xu and other colleagues succeeded in taking a snapshot of a larger nanowire of about one

micrometer -- or one-hundredth the width of a human hair -- that had been partially charged. But the experimental set-up didn't show charging in action.

To view the dynamics of an electrode being charged, Wang and Xu teamed up with Jianyu Huang at DOE's Center for Integrated Nanotechnologies at Sandia National Laboratories in New Mexico and others. The team used a specially outfitted transmission electron microscope to set up a miniature battery. This instrument allowed them to image smaller wires of about 200 nanometers in diameter (about a fifth the width of the previous nanowires) while charging it.

Rechargeable lithium ion batteries work because lithium ions love electrons. Positively charged lithium ions normally hang out in the positive electrode, where a metal oxide shares its electrons with lithium. But charging a battery pumps free electrons into the negative electrode, which sits across a lake of electrolytes through which lithium ions can swim but electrons can't. The lithium desires the electrons on the negative side of the lake more than the electrons it shares with the metal oxide on the positive side. So lithium ions flow from the positive to the negative electrode, pairing up with free electrons there.

But electrons are fickle. Using a battery in a device allows the electrons to slip out of the negative electrode, leaving the lithium ions behind. So without free electron companions, the lithium ions return to the positive electrode and the metal oxide's embrace.

Wang's miniature battery included a positive electrode of lithium cobalt oxide and a negative electrode made from thin nanowires of tin oxide. Between the two electrodes, an electrolyte provided a conduit for lithium ions and a barrier for electrons. The electrolyte was specially designed to withstand the conditions in the microscope.

When the team charged the miniature battery at a constant voltage, lithium ions wicked up through the tin oxide wire, drawn by the electrons at the negative electrode. The wire fattened and lengthened by about 250 percent in total volume, and twisted like a snake.

In addition, the microscopy showed that the wire started out in a crystalline form. But the lithium ions changed the tin oxide to a material like glass, in which atoms are arranged more randomly than in a crystal. The researchers concluded the amount of deformation occurring during charging and use might wear down battery materials after a while. Even so, the tin oxide appeared to fare better as a nanowire than in its larger, bulk form.

"We think this work will stimulate new thinking for energy storage in general," said Wang. "This is just the beginning, and we hope with continued work it will show us how to design a better battery."

Future work will include imaging what happens when such a miniature battery is repeatedly charged and discharged. When a battery gets used, the lithium ions must run back through the tin oxide wire and across the electrolyte to the positive electrode. How much structural damage the receding lithium leaves in its wake will help researchers understand why rechargeable batteries stop working after being recharged so many times.

The researchers would also like to develop a fully functioning nano-sized rechargeable battery.

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Story Source:

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Journal Reference:

1. Jian Yu Huang, Li Zhong, Chong Min Wang, John P. Sullivan, Wu Xu, Li Qiang Zhang, Scott X. Mao, Nicholas S. Hudak, Xiao Hua Liu, Arunkumar Subramanian, Hong You Fan, Liang Qi, Akihiro Kushima, Ju Li6. **In situ observation of the electrochemical lithiation of a single SnO2 nanowire electrode**. *Science*, Dec. 10, 2010 DOI: 10.1126/science.1195628

http://www.sciencedaily.com/releases/2010/12/101209141138.htm

Thought for Food: Imagining Food Consumption Reduces Actual Consumption

If you're looking to lose weight, it's okay to think about eating your favorite candy bar. In fact, go ahead and imagine devouring every last bite -- all in the name of your diet. (Credit: iStockphoto/Lauri Patterson)

ScienceDaily (Dec. 9, 2010) — If you're looking to lose weight, it's okay to think about eating your favorite candy bar. In fact, go ahead and imagine devouring every last bite -- all in the name of your diet.

A new study by researchers at Carnegie Mellon University, published in *Science*, shows that when you imagine eating a certain food, it reduces your actual consumption of that food. This landmark discovery changes the decades-old assumption that thinking about something desirable increases cravings for it and its consumption.

Drawing on research that shows that perception and mental imagery engages neural machinery in a similar fashion and similarly affect emotions, response tendencies and skilled motor behavior, the CMU research team tested the effects of repeatedly imagining the consumption of a food on its actual consumption. They found that simply imagining the consumption of a food decreases ones appetite for it.

"These findings suggest that trying to suppress one's thoughts of desired foods in order to curb cravings for those foods is a fundamentally flawed strategy," said Carey Morewedge, an assistant professor of social and decision sciences and lead author of this study. "Our studies found that instead, people who repeatedly imagined the consumption of a morsel of food -- such as an M&M or cube of cheese -- subsequently consumed less of that food than did people who imagined consuming the food a few times or performed a different but similarly engaging task. We think these findings will help develop future interventions to reduce cravings for things such as unhealthy food, drugs and cigarettes, and hope they will help us learn how to help people make healthier food choices."

For the study, the research team, which included Young Eun Huh, Tepper School of Business Ph.D. candidate, and Joachim Vosgerau, assistant professor of marketing, ran a series of five experiments that tested whether mentally stimulating the consumption of a food reduces its subsequent actual consumption. In the first experiment, participants imagined performing 33 repetitive actions, one at a time. A control group imagined inserting 33 quarters into a laundry machine (an action similar to eating M&M's). Another group imagined inserting 30 quarters into a laundry machine and then imagined eating 3 M&M'S, while a third group imagined inserting three quarters into a laundry machine and then imagined eating 30 M&M'S. Next, all participants ate freely from a bowl filled with M&M'S. Participants who imagined eating 30 M&M'S actually ate significantly fewer M&M'S than did participants in the other two groups.

To ensure that the results were due to imagined consumption of M&M'S rather than the control task, the next experiment manipulated the experience imagined (inserting quarters or eating M&M'S) and the number of

times it was imagined. Again, the participants who imagined eating 30 M&M'S subsequently consumed fewer M&M'S than did the participants in the other groups.

The last three experiments showed that the reduction in actual consumption following imagined consumption was due to habituation -- a gradual reduction in motivation to eat more of the food -- rather than alternative psychological processes such as priming or a change in the perception of the food's taste. Specifically, the experiments demonstrated that only imagining the consumption of the food reduced actual consumption of the food. Merely thinking about the food repeatedly or imaging the consumption of a different food did not significantly influence the actual consumption of the food that participants were given.

"Habituation is one of the fundamental processes that determine how much we consume of a food or a product, when to stop consuming it, and when to switch to consuming another food or product," Vosgerau said. "Our findings show that habituation is not only governed by the sensory inputs of sight, smell, sound and touch, but also by how the consumption experience is mentally represented. To some extent, merely imagining an experience is a substitute for actual experience. The difference between imagining and experiencing may be smaller than previously assumed."

Other implications of this research include the discovery that mental imagery can enact habituation in the absence of pre-ingestive sensory stimulation and that repeatedly stimulating an action can trigger its behavioral consequences.

This research was funded by a grant awarded to Morewedge from the Berkman Faculty Development Fund at Carnegie Mellon.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

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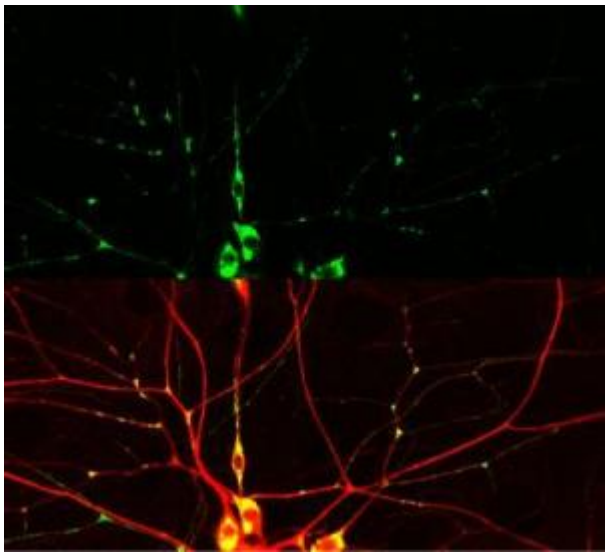
Journal Reference:

1. Carey K. Morewedge, Young Eun Huh and Joachim Vosgerau. **Thought for Food: Imagined Consumption Reduces Actual Consumption**. *Science*, 10 December 2010: Vol. 330 no. 6010 pp. 1530-1533 DOI: 10.1126/science.1195701

http://www.sciencedaily.com/releases/2010/12/101209141134.htm

Key Protein Discovered That Allows Nerve Cells to Repair Themselves



The research led by Rolls describes a newly discovered mechanism that allows microtubules to all grow in the same direction when they arrive at a branch point in dendrites. The scientists propose that one of the proteins that they link to this process acts as an anchor at branch points to concentrate the rest of the machinery that is required. This anchor protein is Apc2. It is linked to a green fluorescent protein and is expressed in neurons in the image. The bright green spots of Apc2-GFP in the upper panel are seen to localize at branch points in the lower panel, where a red marker reveals cell shapes. (Credit: Melissa Rolls Lab, Penn State University)

ScienceDaily (Dec. 9, 2010) — A team of scientists led by Melissa Rolls, an assistant professor of biochemistry and molecular biology at Penn State University, has peered inside neurons to discover an unexpected process that is required for regeneration after severe neuron injury. The process was discovered during Rolls's studies aimed at deciphering the inner workings of dendrites -- the part of the neuron that receives information from other cells and from the outside world.

The research will be published in the print edition of the scientific journal *Current Biology* on 21 December 2010.

"We already know a lot about axons -- the part of the nerve cell that is responsible for sending signals," Rolls said. "However, dendrites -- the receiving end of nerve cells -- have always been quite mysterious." Unlike axons, which form large, easily recognizable bundles, dendrites are highly branched and often buried deep in the nervous system, so they have always been harder to visualize and to study. However, Rolls and her team were able to get around these difficulties. They looked inside dendrites in vivo by using a simple model organism -- the fruit fly -- whose nerve cells are similar to human nerve cells. One of the first mysteries they tackled was the layout of what Rolls referred to as intracellular "highways" -- or microtubules.

"Imagine the nerve cell with two branches -- or arms -- splayed out from it on opposite sides," Rolls explained. "Both arms have highways -- microtubules -- that run along their length and allow all the raw building materials made in the cell body to be carried to the far reaches of the cell. But the highways point in opposite directions. In axons, the growing ends -- or plus ends -- of the microtubules point away from the cell body. In contrast, in the dendrites the plus ends point towards the cell body. No one understands how a single cell can set up two different highway systems."

Unlike many other cells in our bodies, most neurons must last a lifetime. They rely on their key infrastructure -- microtubules -- to be extremely well organized, but also to be flexible so that they can be rebuilt in response to injury. Part of that flexibility comes microtubules' ability to grow constantly. Rolls and her team visualized this growth and realized that there must be a set of proteins controlling just how the highways are laid down at key intersections -- or branch points -- to keep all the microtubules pointing the same way. They identified the proteins, which include the motor protein kinesin-2, and found that when these proteins were missing the microtubules no longer pointed the same way in dendrites; that is, their polarity became disorganized.

After identifying the set of proteins required to maintain an orderly microtubule infrastructure in dendrites, the team tested whether these proteins play a role in the ability of neurons to respond to injury. Most neurons are irreplaceable, and yet they have an incredible ability to regenerate their missing parts. In earlier studies, Rolls and her team had found that, after an axon is cut off and the nerve cell no longer is able to send signals, a new axon grows from the other side of the cell; that is, from a dendrite. As part of this process, the microtubules must flip polarity. In other words, the dendrite highways must be completely rebuilt in the axonal direction. "When we disabled the flies' ability to produce the kinesin-2 protein, we found that the highways could not be rebuilt correctly, and nerve regeneration failed," Rolls explained. "Apparently, kinesin-2 is a crucial protein for polarity maintenance and for the ability to set up a new highway system when neurons need to regenerate."

Rolls also explained that visualizing how nerves maintain their intracellular highways is important for understanding neurodegenerative disease as well as response to nerve injury, which often occurs after accidents and other trauma. If the proteins that control the layout of microtubules, or carry cargo along them, do not function properly, they can become culprits in neurodegenerative diseases such as hereditary spastic paraplegia. "We hope that by showing how microtubules are built in healthy neurons and rebuilt in response to injury, our study might provide insights for future researchers who are developing drug therapies for patients with nerve disease or damage," Rolls said.

This work was funded by an American Heart Association Scientist Development Grant, a March of Dimes Basil O'Connor Starter Scholar Award, the National Institutes of Health, and a Pew Scholar in the Biomedical Sciences award to Melissa Rolls.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

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Journal Reference:

1. Floyd J. Mattie, Megan M. Stackpole, Michelle C. Stone, Jessie R. Clippard, David A. Rudnick, Yijun Qiu, Juan Tao, Dana L. Allender, Manpreet Parmar, and Melissa M. Rolls. **Directed Microtubule Growth, TIPs, and Kinesin-2 Are Required for Uniform Microtubule Polarity in Dendrites**. *Current Biology*, Online December 9, 2010 DOI: 10.1016/j.cub.2010.11.050

http://www.sciencedaily.com/releases/2010/12/101209121418.htm

Adapting Agriculture to Climate Change: New Global Search to Save Endangered Crop Wild Relatives

Rice field at central Vietnam. (Credit: iStockphoto/Olga Khoroshunova)

ScienceDaily (Dec. 9, 2010) — The Global Crop Diversity Trust has announced a major global search to systematically find, gather, catalogue, use, and save the wild relatives of wheat, rice, beans, potato, barley, lentils, chickpea, and other essential food crops, in order to help protect global food supplies against the imminent threat of climate change, and strengthen future food security.

The initiative, led by the Global Crop Diversity Trust, working in partnership with national agricultural research institutes, Royal Botanic Gardens, Kew, and the Consultative Group on International Agricultural Research (CGIAR), is the largest one ever undertaken with the tough wild relatives of today's main food crops. These wild plants contain essential traits that could be bred into crops to make them more hardy and versatile in the face of dramatically different climates expected in the coming years. Norway is providing US$50 million towards this important contribution to food security.

"All our crops were originally developed from wild species -- that's how farming began," explained Cary Fowler, Executive Director of the Global Crop Diversity Trust. "But they were adapted from the plants best suited to the climates of the past. Climate change means we need to go back to the wild to find those relatives of our crops that can thrive in the climates of the future. We need to glean from them the traits that will enable modern crops to adapt to new, harsher and more demanding situations. And we need to do it while those plants can still be found."

Crop wild relatives make up only a few percent of the world's genebank holdings, yet their contribution to commercial agriculture alone is estimated at more than US$100 billion per year. One example dates back to the 1970s, when an outbreak of grassy stunt virus, which prevents the rice plant from flowering and producing grain, decimated rice harvests across Asia. Scientists from the International Rice Research Institute (IRRI) screened more than 10,000 samples of wild and locally-cultivated rice plants for resistance to the disease and found it in a wild relative, Oryza nivara, growing in India. The gene has been incorporated into most new varieties since the discovery.

"This project represents one of the most concrete steps taken to date to ensure that agriculture, and humanity, adapts to climate change. At a more fundamental level, the project also demonstrates the importance of

biodiversity and genetic resources for human survival," said Erik Solheim, Minister of the Environment and International Development of Norway, which is providing the initial budget of US$50 million to fund the work on 23 global food crops: alfalfa, bambara groundnut, banana, barley, bean, fava bean, chickpea, cowpea, finger millet, grass pea, lentil, oat, pea, pearl millet, pigeon pea, potato, rye, rice, sorghum, sunflower, sweet potato, vetch and wheat. The work is scheduled to take 10 years, from determining where to collect, through to having material ready for crop breeding programs.

Although plant breeders have incorporated many traits from the wild relatives of our crops over the years, the plants have never been comprehensively collected or conserved, according to the Global Crop Diversity Trust. As a result, valuable traits are largely unavailable to plant breeders and farmers and many are at risk of being lost forever due to climate change and rapid habitat loss. According to the UK's Royal Botanic Gardens, Kew, a major partner in the project, one-fifth of the world's plants are threatened with extinction.

It is widely understood that, irrespective of the outcomes at the United Nations' climate change conference in Cancún, the coming decades will see ever more challenging conditions for agriculture. The forecasts for declining yields are particularly frightening for the developing world. For example, yields for maize in Southern Africa, a vital crop in a region which already suffers from chronic hunger, are predicted to fall by up to 30 percent within just 20 years. The standard response until now has been that new, hardier varieties of our crops will be required.

"We are taking a step back and challenging the lazy assumption that new crop varieties will just materialize out of thin air," said Solheim. "The aim of the project is to collect wild crop diversity and put it into the crop breeding pipeline before this treasure is lost from the wild forever. This is a two-fold race against time -- the race to adapt agriculture to climate change, and the race to collect biodiversity before it is lost forever. We are extremely excited to support a project that will help insure our common future, and look forward to other donors adding their support so that more crops can be included." Norway showed its deep commitment to conserving the world's plant biodiversity in 2008, when it built the Svalbard Global Seed Vault, offering a secure Arctic home for millions of seed samples collected from around the world.

"Diversity equals resilience in the biological world, which is why this project is vital to the survival of agriculture," said Paul Smith, Director of the Millennium Seed Bank at the Royal Botanic Gardens, Kew, and a key partner in the project. Kew's unparalleled experience in wild plant collecting and seed biology will be brought to bear not just on a conservation problem, but on the whole issue of food security, added Smith.

According to the partners, the scale of loss in the wild is not the only urgent factor. On average, a new crop variety takes 7-10 years to breed, so it is essential for the work to begin now, before the effects of climate change begin to wreak havoc on food production. "Improving food security means helping farmers today," said Solheim, "but also taking steps to ensure they will be able to adapt to changes in the future. If we wait until the climate has changed, it will be too late. Delaying adaptation is short-sighted and the poor will pay the heaviest price."

The program will target critical traits in the wild relatives of crops that are essential, especially in the developing world, where climate change could cause production declines of between 10 and 30 percent or more. Wild relatives of crop plants tend to be much more diverse than their domesticated cousins. They grow in a wider variety of climates and conditions.

The Global Crop Diversity Trust will draw in climate change experts, biodiversity conservationists and agricultural scientists. Scientists will work with national governments and local partners on the ground, and the species to be collected all fall under the auspices of the International Treaty on Plant Genetic Resources for Food and Agriculture. All materials will be collected and be publicly available under the terms of that Treaty.

Collecting is only the first step. The aim is not simply to collect and conserve, but to use and thus benefit from this diversity. However, these wild plants cannot be used straight away in a crop breeding program -- as wild plants contain many characteristics that are undesirable for crops, along with the desirable ones. The 10-year scope of the project will therefore ensure that collected seed can be grown and crossed with existing breeding lines, a process known as "pre-breeding," to see if the traits of interest can then be introduced effectively into domesticated plants. Once this is done, the diversity is available to all plant breeders, everywhere.

Preservation and Progress

Samples will be conserved in a number of sites around the world, including the Svalbard Global Seed Vault, and the genetic material and information will be shared electronically and openly. The project will also provide training to partners in the developing world in identifying and handling wild species and in plant-breeding techniques. "Variable temperatures, pests, diseases, droughts and floods are agricultural problems that have always been with us," said Fowler, "but climate change will be like putting such traditional agricultural problems on steroids." This initiative will create an unprecedented resource for developing "climate-ready" food crops.

For example, wild plants could address the issue of rice's temperature sensitivity. At a critical stage in rice flowering, a one degree Celsius change in temperature can cut yields by 10 percent. Most high-yield rice varieties flower during the heat of the day, but some wild rice relatives flower at night. "With climate change, temperatures rising by a few degrees could cut yields by 30 to 40 percent," said Fowler. "But if we could just incorporate the characteristic of night-flowering from wild rice into farmed rice, we could save millions of tons of rice, and thousands of lives. That would pay for the project many times over."

"This is a game changer," said Fowler. "This project will provide us with enormous amounts of diversity, and will provide plant breeders and farmers around the world with access to that diversity. We're going to find resistance to diseases and pests that farmers have never had before. If -- and it remains an 'if' -- we are to adapt agriculture to climate change, we need to stack the odds heavily in the farmers' favor. This does just that."

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

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http://www.sciencedaily.com/releases/2010/12/101209201938.htm

New Kind of Blast-Resistant Glass

An engineer from the University of Missouri studies the glass pane after a test explosion. (Credit: DHS S&T)

ScienceDaily (Dec. 9, 2010) — Whether in a hurricane, tornado, or bomb attack, a leading cause of injury and death is often fast-flying shards of glass. Explosions and high winds can cause windows in buildings to shatter-spewing jagged pieces of glass in every direction.

A Pentagon report on the 1996 Khobar Towers bombing in Saudi Arabia, for example, noted:

Two of the 19 deceased had injuries know to be caused by glass fragments that were severe enough to cause death even without other contributing forces. Of the remaining 17 deceased, 10 had glass injuries that were significant and which may have caused death even without blunt force trauma. Thus, for 12 of 19 deaths, glass fragmentation was a significant factor. More than 90% of the people injured suffered laceration injuries, many of which were significant.

With an international research grant from the Department of Homeland Security's Science and Technology Directorate (S&T), a team of engineers from the University of Missouri and the University of Sydney in Australia is working to develop a blast-resistant glass that is lighter, thinner, and colorless, yet tough enough to withstand the force of an explosion, earthquake, or hurricanes winds.

Installing blast-resistant glass in buildings that are potential targets of attacks or in regions prone to severe weather can save lives. But current blast-resistant glass technology-the kind that protects the windows of key federal buildings, the president's limo, and the Popemobile -is thicker than a 300-page novel-so thick it cannot be placed in a regular window frame. This makes it very difficult-and expensive-to replace standard glass windows in present structures.

Unlike today's blast-resistant windows which are made of pure polymer layers, this new design is a plastic composite that has an interlayer of polymer reinforced with glass fibers-and it's only a quarter-inch thick.

The project team recently subjected their new glass pane to a small explosion. "The results were fantastic," exclaimed Sanjeev Khanna, the project's principal investigator and an associate professor of mechanical engineering at Missouri. "While the discharge left the pane cracked, the front surface remained completely intact."

The secret to the design's success is long glass fibers in the form of a woven cloth soaked with liquid plastic and bonded with adhesive. The pane is a layer of glass-reinforced clear plastic between two slim sheets of glass. Even the glue that holds it all together is clear. Think of it as a sandwich: the slim sheets of glass are the two slices of break; the liquid plastic and long glass fibers make up the crunchy peanut butter in the middle.

The glass fibers are typically 15 to 25 micrometers in diameter, about half the thickness of a typical human hair. The small size results in fewer defects and a decreased chance of cracking. The strong glass fibers also provide a significant reinforcing effect to the polymer matrix used to bind the fibers together. The more fibers used, the stronger the glass reinforcement. And while traditional blast-proof glass usually has a greenish ting, special engineering renders the polymer resin transparent to visible light.

Engineers expect the new design will be comparable in cost to current blast-proof glass panes, but lighter in weight. At only a quarter-inch thick, this newly engineered composite would slip into standard commercial window frames, making it much more practical and cost-efficient to install.

"Designing an affordable, easy-to-install blast-resistant window could encourage widespread use in civilian structures, thereby protecting the lives of occupants against multiple threats and hazards," notes John Fortune, manager of the project for the Infrastructure and Geophysical Division at S&T.

To date, the glass has been tested with small-scale prototypes. "In future tests, the size of the glass panels will be increased by two to four times to determine the effect of size on blast resistance," said Khanna.

The goal is to create blast-resistant panes as large as 48 by 66 inches-the standard General Services Administration window size for qualification blast testing-that can still be cost-effective. While dependent on results from upcoming tests, Khanna hopes this glass could become commercially available in three to four years.

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Story Source:

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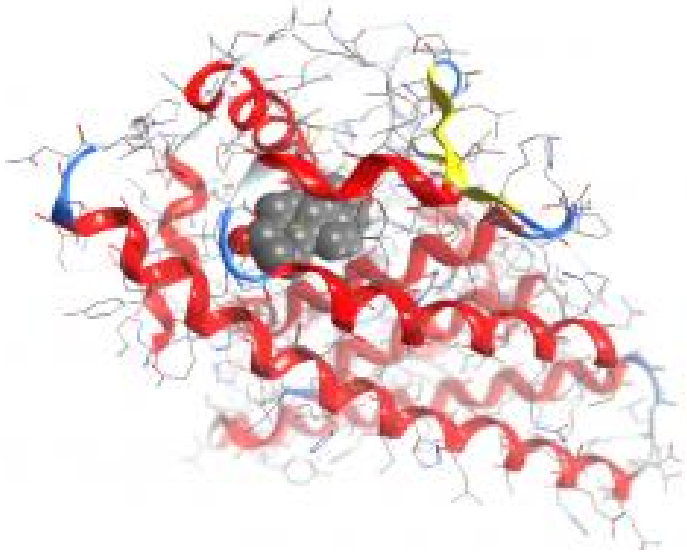
http://www.sciencedaily.com/releases/2010/12/101209185606.htm

Supercomputing Research Opens Doors for Drug Discovery



Supercomputers could help speed up the drug discovery process by identifying suitable chemicals (seen as gray spheres) that can dock onto a designated target in the body, such as a protein (seen as red ribbons). (Credit: Image courtesy of DOE/Oak Ridge National Laboratory)

ScienceDaily (Dec. 9, 2010) — A quicker and cheaper technique to scan molecular databases developed at the Department of Energy's Oak Ridge National Laboratory could put scientists on the fast track to developing new drug treatments.

A team led by Jerome Baudry of the University of Tennessee-ORNL Center for Molecular Biophysics adapted a widely used existing software to allow supercomputers such as ORNL's Jaguar to sift through immense molecular databases and pinpoint chemical compounds as potential drug candidates.

The research was published in the Journal of Computational Chemistry as "Task-parallel MPI implementation of Autodock4 for docking of very large databases of compounds using High Performance Super-Computers."

"Our research is the missing link between supercomputers and the huge data available in molecular databases like the Human Genome Project," Baudry said. "We have an avalanche of data available to us, and now we need to translate that data into knowledge."

Such translation is critical for the first stages of drug development, in which researchers look for appropriate chemicals that interact with a target in the body, typically a protein. If the chemical is suitable, it attaches onto the protein and produces a desirable effect in the cell.

But with thousands of known proteins and millions of chemicals as potential drugs, the number of possible combinations is astronomical.

"It is very expensive and time-consuming to measure these interactions experimentally," Baudry said. "But with supercomputers, we can process millions of molecules a day."

The quick and efficient processing of molecules offers scientists an opportunity to take risks on previously unexamined drug candidates, which could lead to diverse and innovative classes of drugs.

"Before, we threw away a lot of information because molecules did not have a preferred profile," Baudry said. "Now, every molecule can be examined without worrying about wasting resources."

The researchers have already started work to launch the research into reality through a new collaboration supported by the National Institutes of Health. The project team plans to put the computational development to work on ORNL supercomputers to look for chemicals that could treat prostate cancer. The research is funded by a NIH Clinical Translational Science Award, which was awarded to Georgetown and Howard Universities and includes ORNL, Med/Star Health and the Washington D.C. Veterans Affairs Medical Center as key partners.

"Our development work is the computational equivalent of building the Saturn V rocket," Baudry said. "Now we want to fly it to the moon."

Funding for the initial development work was provided by ORNL's Laboratory Directed Research and Development program. The University of Tennessee and the Joint UT/ORNL Genome Sciences and Technology graduate program also supported the work. The research team included Barbara Collignon, Roland Schulz and Jeremy Smith of the UT-ORNL Center for Molecular Biophysics. The three researchers as well as Baudry are also affiliated with the University of Tennessee's Department of Biochemistry and Cellular and Molecular Biology.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **DOE/Oak Ridge National Laboratory**.

http://www.sciencedaily.com/releases/2010/12/101209164146.htm

Bering Sea Chill Yields Fatter Plankton, Pollock Diet Changes

Themisto libellula. (Credit: Photo by Russ Hopcroft)

ScienceDaily (Dec. 9, 2010) — Despite a 30-year warming trend, the last three years in the Bering Sea have been the coldest on record. A University of Alaska Fairbanks scientist says that the cold temperatures have helped produce larger zooplankton in the Bering Sea, which may be changing the way Walleye pollock are feeding.

Alexei Pinchuk, research professional at the UAF Seward Marine Center, has spent the last three years gathering zooplankton samples in the Bering Sea. He and his colleagues have been looking at how changes in temperature in the Bering Sea affect resident zooplankton, and in turn how those zooplankton shifts may affect the diet of Walleye pollock.

During colder years, like the last three, pollock tend to eat the larger zooplankton, like copepods and krill, which flourish in chillier temperatures. Pinchuk has also found that the recent cold temperatures have brought an arctic "sand-flea," the amphipod *Themisto libellula*, south into Bering Sea waters.Young salmon and pollock seem to prefer to eat these amphipods over other, smaller zooplankton.

In warmer years, which include the record-setting high temperatures of 2001 to 2005, smaller zooplankton tend to thrive. According to Pinchuk and his colleagues, younger pollock tend to eat the smaller plankton, while larger pollock favor the larger plankton found in colder waters. This causes younger pollock to start out doing well in warmer temperatures, but as the pollock grow bigger, they may not be able to find the larger zooplankton prey they need to produce enough fat for overwintering.

"The larger pollock may then eat their smaller cousins instead," said Pinchuk.

Pinchuk conducted his research on board the U.S. Coast Guard Cutter Healy, R/V Knorr and R/V Thomas G. Thompson. He collected his zooplankton samples using multiple collecting nets.

Although the last few years have been cold, scientists predict that the warming trend in the Bering Sea will continue.

Pinchuk's findings were recently featured in the Nov. 4 issue of the journal *Nature*. His work is part of the broad Bering Sea Project, a six-year, $52 million integrated ecosystem study of the Bering Sea. The Bering Sea Project" is funded by both the National Science Foundation and the North Pacific Research Board.

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

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

Journal Reference:

1. Wendee Holtcamp. **Marine science: The tiniest catch**. *Nature*, 2010; 468 (7320): 26 DOI: 10.1038/468026a

http://www.sciencedaily.com/releases/2010/12/101209152801.htm

Neutron Stars and String Theory in a Lab: Chilled Atoms Give Clues to Deep Space and Particle Physics

Artist's rendering of a neutron star. (Credit: NASA/Dana Berry)

ScienceDaily (Dec. 9, 2010) — Using lasers to contain some ultra-chilled atoms, a team of scientists has measured the viscosity or stickiness of a gas often considered to be the sixth state of matter. The measurements verify that this gas can be used as a "scale model" of exotic matter, such as super-high temperature superconductors, the nuclear matter of neutron stars, and even the state of matter created microseconds after the Big Bang.

The results may also allow experimental tests of string theory in the future.

Duke physicist John Thomas made the viscosity measurements using an ultra-cold Fermi gas of lithium-6 atoms trapped in a millimeter-sized bowl made of laser light. When cooled and placed inside a magnetic field of the correct size, the atoms interact as strongly as the laws of quantum mechanics allow. This strongly interacting gas exhibits "remarkable properties," such as nearly frictionless fluid flow, Thomas said.

The team's report appears in the Dec. 10 issue of *Science*.

Under the ultra-cold conditions, the properties of the gas are determined by a universal ruler, or natural length scale, much like the scale on an architect's drawing. The ruler for the atomic gas is the average spacing between the atoms. According to quantum physics, this spacing determines all other natural scales, such as the scale for energy, temperature and viscosity, making the ultra-cold gas a scale model for other exotic matter. Thomas said that he and others have verified the gas as a universal scale model for properties such as temperature, but this is the first time they've tested the scaling of viscosity, which happens to be of particular interest to scientists right now.

Thomas first measured the viscosity of the gas at a few billionths of a degree Kelvin, or -459 degrees Fahrenheit. Turning off the trap that confines the gas, and then recapturing it caused the radius of the Fermi gas to vibrate. The oscillation, called a breathing mode, resembles the jiggling of a piece of jelly. The longer the vibrations lasted, the lower the viscosity. At slightly higher temperatures, millionths of a degree Kelvin,

the researchers instead observed how fast the gas changed from a cigar shape to a pancake after being released from the trap. A slower change in shape had a higher viscosity.

These results are "extremely important to the field of condensed matter physics and to high temperature superconductivity in particular," said Kathy Levin, a theorist at the University of Chicago, who was not involved in the research. She said that the viscosity of the Fermi gas is similar to the conductivity of a superfluid, which flows with no resistance. This "perfect fluidity" is also observed in the condensed matter world, especially in materials used to make high temperature superconductors. The new data, especially at lower temperatures, "seem quite consistent" with predictions of how superconductors should flow, Levin said.

The Fermi gas as a scale model is also important for studying elements of the cosmos that scientists can't probe in a lab, said Duke physicist Berndt Mueller. Even a very small chunk of a neutron star, a dead star that hasn't become a black hole, would weigh billions of tons on Earth and be much too dense to study. The data showing the universal properties of the Fermi gas, however, let physicists calculate the scale from lithium-6 atomic spacing to the spacing between neutrons in these stars. The measurements made on the Fermi gas can then be used to determine the natural energy and other properties for these stars, which can be compared to theorists' predictions. Similar calculations can be made for the quark-gluon plasma, the state of matter created just microseconds after the Big Bang and being studied in particle accelerators such as the Large Hadron Collider in Geneva.

Thomas said the new results also give experimental insight into predictions made using string theory, the mathematical construct uniting the classical world of gravity with quantum physics. String theorists have provided a lower bound for the ratio of the viscosity or fluid flow to the entropy, or disorder, in a strongly-interacting system. The new experiments measured both properties in the Fermi gas and showed that the gas minimum is between four and five times the string theorists' lower bound.

"The measurements do not test string theory directly," Thomas said, noting a few caveats-- the lower bound is derived for high-energy systems, where Einstein's theory of relativity is essential, while the Fermi gas experiments study low-energy gases. If string theorists create new calculations specifically for a Fermi gas, scientists would be able to make precise experimental tests of the theory with equipment no larger than a desktop.

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

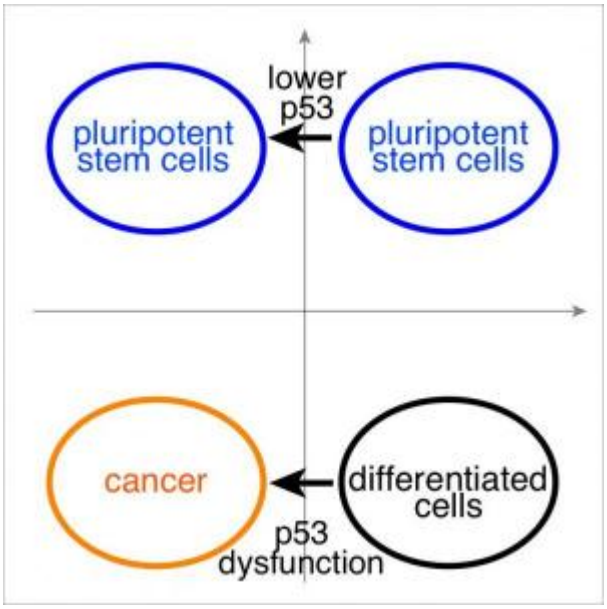
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Duke University**.

Journal Reference:

1. C. Cao, E. Elliott, J. Joseph, H. Wu, J. Petricka, T. Schäfer, and J. E. Thomas. **Universal Quantum Viscosity in a Unitary Fermi Gas**. *Science*, 2010; DOI: 10.1126/science.1195219

http://www.sciencedaily.com/releases/2010/12/101209152755.htm

Scientists Peer Into the Future of Stem Cell Biology



When several hundred members of a class of molecules called microRNAs are measured it becomes possible to distinguish different cell types including the discovery that stem cells fall into two broad categories. (Credit: Pierre Neveu, UCSB)

ScienceDaily (Dec. 9, 2010) — Remarkable progress in understanding how stem cell biology works has been reported by a team of leading scientists, directed by experts at UC Santa Barbara. Their research has been published in the journal *Cell Stem Cell.*

Stem cell biology is making waves around the world with great hope for the eventual repair of parts of the body. While many scientists see these breakthroughs as viable, there are hurdles that must be overcome, including the worrisome potential for introducing cancer when making a repair to an organ.

Significant interdisciplinary research in stem cells is being performed at UC Santa Barbara, by a team of neurobiologists and physicists, with assistance from scientists at Harvard Medical School, UCLA's Geffen School of Medicine, and the Yale Stem Cell Center.

The paper is a collaboration between biology, physics, and engineering. The two first authors are Pierre Neveu, of the Neuroscience Research Institute (NRI) and UCSB's Kavli Institute of Theoretical Physics (KITP); and Min Jeong Kye, of the NRI, MCDB, UCSB's Center for Stem Cell Biology and Engineering.

An important concept in this research is pluripotency -- the ability of the human embryonic stem cell to differentiate or become almost any cell in the body, explained senior author Kenneth S. Kosik, professor in the Department of Molecular, Cellular & Developmental Biology (MCDB). Kosik is also the Harriman Chair in Neuroscience Research and co-director of the NRI. And, Kosik is a practicing physician specializing in Alzheimer's Disease.

"The beauty and elegance of stem cells is that they have these dual properties," said Kosik. "On the one hand, they can proliferate -- they can divide and renew. On the other hand, they can also transform themselves into any tissue in the body, any type of cell in the body."

Kosik said that scientists have learned that many cells in the body have the potential to become pluripotent cells. "The big engines of change are the transcription factors," said Kosik. "They drive the laboratory procedure by which we can reverse the progression during development from stem cell to differentiated cell and use differentiated cells from our skin to make stem cells."

With human embryonic stem cells, Kosik explained that for some time he and his team have been studying a set of control genes called microRNAs. "To really understand microRNAs, the first step is to remember the central dogma of biology --DNA is the template for RNA, and RNA is translated to protein. But microRNAs stop at the RNA step and never go on to make a protein."

According to Kosik, it doesn't matter how scientists make or obtain stem cells for research. They can be bona fide human embryonic stem cells (HESC) or induced pluripotent stem cells (IPSC) induced from a skin cell. The microRNA patterns don't "respect" how the cells were made, Kosik said. The team found that all pluripotent stem cells are not identical, but did not differ by how they originated. The scientists found two groups of stem cells, irrespective of origin. MicroRNA profiles proved this.

When looking at microRNA, the overall profile is an extraordinarily good predictor -- maybe the best predictor -- of what type of cell you have. "You could be looking through the microscope at a tumor, and you may not be sure about that tumor," said Kosik. "Maybe the tumor is in the brain, but you don't know whether it is a brain tumor, or a metastasis from somewhere else. You can't always tell exactly what type of cells they are.

"The microRNAs will tell you," said Kosik. "Those profiles can tell you the different types of cancer; they can tell you the different types of cells; they can distinguish stem cells from other cells; and they can distinguish skin cells from brain cells. Those profiles, when you look at them in their totality, offer a unique signature that can inform you as to what type of cell you have. So that's a very important property of these microRNAs."

The scientists looked at 400 different microRNAs in both embryonic and induced pluripotent cells. Humans have approximately 1,000 microRNAs.

Pluripotent stem cells have some similarity to cancer cells. They are immortal. They self-renew. Tumors keep dividing. So do pluripotent stem cells. "That's their property, self-renewal, proliferation," said Kosik. "And that's what cancer does. How can it be that pluripotent stem cells can self-renew and are not cancer, but cancer cells self-renew and are cancer? Cancer lacks any control over itself. What's the difference?"

The scientists included studies of 40 types of differentiated body cells, in the microRNA testing. They found that the microRNA was very different in the cancer cells and the differentiated cells. This was not a surprise.

The surprise was that when looking at pluripotent cells, some are more more similar to cancer and others are less similar.

"One of the big problems that people worry about in the use of stem cells for the repair of body parts, is whether or not you are going to be creating cancer," said Kosik. "That's a big worry ¬¬-- one of the major worries. So if we have a way here, and this we don't know yet, but if these microRNA profiles that look like cancer indicate a propensity toward cancer, then that would be very nice to know. But we don't know that yet."

He explained two possibilities: If doctors are going to use stem cells for body repairs, they don't want them to be cancerous, but they do want them to have enough growth potential that they will really make a difference. "So maybe they should look a little bit like cancer," said Kosik. "On the other hand, you don't want them to

become a tumor. So maybe you want them to look a little less like cancer. At this point you could make either argument. We just don't know."

Scientists at UCSB will be working on the answers.

Additional authors are Shuping Qi and Harley I. Kornblum, David Geffen School of Medicine, UCLA; David E. Buchholz and Dennis Clegg, UCSB's NRI, MCDB, and Center for Stem Cell Biology and Engineering; Mustafa Sahin, Harvard Medical School; In-Hyun Park, Harvard Stem Cell Institute and Yale Stem Cell Center; Kwang-Soo Kim, Harvard Medical School; George Q. Daley, Harvard Stem Cell Institute; and Boris I. Shraiman, UCSB Department of Physics and KITP.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

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Journal Reference:

1. Pierre Neveu, Min Jeong Kye, Shuping Qi, David E. Buchholz, Dennis O. Clegg, Mustafa Sahin, In-Hyun Park, Kwang-Soo Kim, George Q. Daley, Harley I. Kornblum. **MicroRNA Profiling Reveals Two Distinct p53-Related Human Pluripotent Stem Cell States**. *Cell Stem Cell*, 2010; 7 (6): 671 DOI: 10.1016/j.stem.2010.11.012

http://www.sciencedaily.com/releases/2010/12/101209152742.htm

Time Running out to Save Climate Record Held in Unique Eastern European Alps Glacier

Researchers atop Mount Ortles in the eastern Alps are using a manual hand auger to drill a shallow core for later analysis. Below, they are installing an ablation stick, near a recently dug snow pit, to help in establishing the mass balance of the ice field. (Credit: Image courtesy of Ohio State University)

ScienceDaily (Dec. 9, 2010) — A preliminary look at an ice field atop the highest mountain in the eastern European Alps suggests that the glacier may hold records of ancient climate extending back as much as a thousand years.

Researchers warn, however, that the record may soon be lost as global warming takes its toll on these high-altitude sites, according to a new study in the *Journal of Glaciology*.

The glacier, Alto dell'Ortles, is the highest large ice body in the eastern Alps, reaching an altitude of 12,812 feet (3,905 meters) above sea level. It is small, though, measuring barely 0.4 square miles (1.04 square kilometers), and only 10 percent of that is likely to hold a good climate record, the researchers said.

"This is a mountain that is very difficult to climb and that has probably prevented researchers and glaciologists from Europe from going up there to study the ice," explained Paolo Gabrielli, a research scientist with the School of Earth Sciences and the Byrd Polar Research Center, both at Ohio State University.

"But it is an ideal observatory to have monitored climatic change in the region in the past as well as currently."

Scientists from Ohio State and five European universities made two exploratory visits to the glacier site in the summers of 2007 and 2008 and then, with logistical support from the Fire Protection and Civil Division of the Autonomous Province of Bolzano, used helicopters to carry the team to the site in 2009.

While there, the researchers drilled a shallow 10-meter core at the surface and dug snow pits to gauge how well the ice had been preserved over time. Later analysis showed that while some surface melting had partially degraded the recent record, ice formed before 1980 is likely to be unharmed.

The team also used ground-penetrating radar to map the thickness of the glacier. Based on that, they hope to be able to retrieve a 70-meter-long core through the ice to bedrock. "There is a possibility that we could find ice reaching back 5,000 years, but that's just speculation until we actually drill," Gabrielli said.

The Ortles site is unique in the Eastern Alps, they say, since it offers the chance to reconstruct the human history of the region along with the past ecosystems and climate, and show, perhaps, the relationship between the three.

"We hope to find out how these three factors interacted. We'd like to find evidence of whether climate conditions influenced the development of agriculture here, or even the start of primitive mining and smelting operations. We may even be able to see indications in the ice record of when people came to the region," he said.

Once full cores were retrieved, the ice samples would be analyzed for a host of climate signals, including oxygen isotope ratios, heavy metals, organic material, sulfates, chlorides, dust, pollen and volcanic ash that offer indications of past climate conditions. That record would then be compared to records from other cores drilled from ice caps around the globe.

The research team has submitted a proposal to the National Science Foundation to support the planned drilling project.

"This is basically the only hope of finding a record of changing climate conditions at high elevations in this part of Europe," he said, adding, "but unfortunately, time is running out to save this ice."

Working with Gabrielli on the project were Lonnie Thompson, Mary Davis, and Victor Zagorodnov, all from Ohio State; L. Carturan and G. Dalla Fontana, both from the University of Padova; J. Gabrieli and C. Barbante, both from the University of Venice; R. Dinale from the Autonomous Province of Bolzano; K. Krainer from the University of Innsbruck; H. Hausmann from the Vienna University of Technology, and R. Seppi from the University of Pavia.

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Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Ohio State University**. The original article was written by Earle Holland.

Journal Reference:

1. P. Gabrielli, L. Carturan, J. Gabrieli, R. Dinale, K. Krainer, H. Hausmann, M. Davis, V. Zagorodnov, R. Seppi, C. Barbante, G. Dalla Fontana, L.G. Thompson. **Atmospheric warming threatens the untapped glacial archive of Ortles mountain, South Tyrol**. *Journal of Glaciology*, Vol. 56, No. 199, 2010

http://www.sciencedaily.com/releases/2010/12/101209121427.htm

Astronomers Open New Window Into Early Universe: Epoch of Reionization

Bowman attaches the coaxial cable to the first-stage analog receiver electronics (the receiver is the metal box). The cable runs from the computer housed inside the hut to the receiver, which is located under the antenna. (Credit: Judd Bowman)

ScienceDaily (Dec. 8, 2010) — Thirteen billion years ago our universe was dark. There were neither stars nor galaxies; there was only hydrogen gas left over after the Big Bang. Eventually that mysterious time came to an end as the first stars ignited and their radiation transformed the nearby gas atoms into ions. This phase of the universe's history is called the Epoch of Reionization (EoR), and it is intimately linked to many fundamental questions in cosmology. But looking back so far in time presents numerous observational challenges.

Arizona State University's Judd Bowman and Alan Rogers of Massachusetts Institute of Technology have developed a small-scale radio astronomy experiment designed to detect a never-before-seen signal from the early universe during this period of time, a development that has the potential to revolutionize the understanding of how the first galaxies formed and evolved.

"Our goal is to detect a signal from the time of the Epoch of Reionization. We want to pin down when the first galaxies formed and then understand what types of stars existed in them and how they affected their environments," says Bowman, an assistant professor at the School of Earth and Space Exploration in ASU's College of Liberal Arts and Sciences.

Bowman and Rogers deployed a custom-built radio spectrometer called EDGES to the Murchison Radio-astronomy Observatory in Western Australia to measure the radio spectrum between 100 and 200 MHz. Though simple in design -- consisting of just an antenna, an amplifier, some calibration circuits, and a computer, all connected to a solar-powered energy source -- its task is highly complex. Instead of looking for early galaxies themselves, the experiment looks for the hydrogen gas that existed between the galaxies. Though an extremely difficult observation to make, it isn't impossible, as Bowman and Rogers have demonstrated in their paper published in *Nature* on Dec. 9.

"This gas would have emitted a radio line at a wavelength of 21 cm -- stretched to about 2 meters by the time we see it today, which is about the size of a person," explains Bowman. "As galaxies formed, they would have ionized the primordial hydrogen around them and caused the radio line to disappear. Therefore, by constraining when the line was present or not present, we can learn indirectly about the first galaxies and how they evolved in the early universe." Because the amount of stretching, or redshifting, of the 21 cm line increases for earlier times in the Universe's history, the disappearance of the inter-galactic hydrogen gas should produce a step-like feature in the radio spectrum that Bowman and Rogers measured with their experiment.

Radio measurements of the redshifted 21 cm line are anticipated to be an extremely powerful probe of the reionization history, but they are very challenging. The experiment ran for three months, a rather lengthy observation time, but a necessity given the faintness of the signal compared to the other sources of emission from the sky.

"We carefully designed and built this simple instrument and took it out to observe the radio spectrum and we saw all kinds of astronomical emission but it was 10,000 times stronger than the theoretical expectation for the signal we are looking for," explains Bowman. "That didn't surprise us because we knew that going into it, but it means it's very hard to see the signal we want to see."

The low frequency radio sky is dominated by intense emission from our own galaxy that is many times brighter than the cosmological signal. Add to that the interference from television, FM radio, low earth orbit satellites, and other telecommunications radio transmitters (present even in remote areas like Australia's Outback) and it is a real challenge. Filtering out or subtracting these troublesome foreground signals is a principal focus of instrument design and data analysis techniques. Fortunately, many of the strongest foregrounds have spectral properties that make them possible to separate from the expected EoR signals.

After careful analysis of their observations, Bowman and Rogers were able to show that the gas between galaxies could not have been ionized extremely rapidly. This marks the first time that radio observations have directly probed the properties of primordial gas during the EoR and paves the way for future studies. "We're breaking down barriers to open an entirely new window into the early universe," Bowman says.

The next generation of large radio telescopes is under construction right now to attempt much more sophisticated measurements of the 21 cm line from the EoR. Bowman is the project scientist for one of the telescopes called the Murchison Widefield Array. According to him, the most likely physical picture for the EoR looked like a lot of bubbles that started percolating out from galaxies and then grew together -- but that idea needs to be tested. If lots of galaxies all put out a little bit of radiation, then there would be many little bubbles everywhere and those would grow and eventually merge like a really fizzy and frothy foam. On the other hand, if there were just a few big galaxies that each emitted a lot of radiation then there would have been only a few big bubbles that grew together.

"Our goal, eventually, is to make radio maps of the sky showing how and when reionization occurred. Since we can't make those maps yet, we are starting with these simple experiments to begin to constrain the basic properties of the gas and how long it took for galaxies to change it," explains Bowman. "This will improve our understanding of the large-scale evolution of the universe."

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

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.

Journal Reference:

1. Judd D. Bowman, Alan E. E. Rogers. **A lower limit of Δz□>□0.06 for the duration of the reionization epoch**. *Nature*, 2010; 468 (7325): 796 DOI: 10.1038/nature09601

http://www.sciencedaily.com/releases/2010/12/101208132210.htm

Parents' Influence on Children's Eating Habits Is Limited

Happy family dining together in the kitchen. As primary caregivers, parents are often believed to have a strong influence on children's eating behaviors. However, findings on parent-child resemblance in dietary intakes are mixed. (Credit: iStockphoto)

ScienceDaily (Dec. 8, 2010) — As primary caregivers, parents are often believed to have a strong influence on children's eating behaviors. However, previous findings on parent-child resemblance in dietary intakes are mixed. Researchers from the Johns Hopkins Bloomberg School of Public Health reviewed and assessed the degree of association and similarity between children's and their parents' dietary intake based on worldwide studies published since 1980.

The meta-analysis is featured in the December issue of the *Journal of Epidemiology and Community Health*.

"Contrary to popular belief, many studies from different countries, including the United States, have found a weak association between parent-child dietary intake," said Youfa Wang, MD, PhD, MS, lead author of the study and an associate professor with the Bloomberg School's Department of International Health. "This is likely because young people's eating patterns are influenced by many complex factors, and the family environment plays only a partial role. More attention should be given to the influence of the other players on children's eating patterns such as that of schools, the local food environment and peer influence, government guidelines and policies that regulate school meals, and the broader food environment that is influenced by food production, distribution and advertising." He added, "Parents need to be better empowered to be good role models and help their children eat a healthy diet."

Wang, along with colleagues from the National Institute on Aging and the University of Zaragoza in Spain, systematically reviewed and analyzed relevant studies published in different countries between 1980 and 2009. They compared the correlations between parent-child pairs' dietary intakes, by type of parent-child pairs (for example, mother-daughter vs. father-son), world regions and dietary assessment methods, and over time. They found differences in parent-child dietary intake resemblance, across nutrients and dietary assessment approaches. In addition, the meta-analysis provided evidence that correlations have become weaker over time.

Compared to non-European countries, in particular, parent-child correlations in intakes of energy and total fat seem to be weaker in the U.S.

"Findings of this study will help enhance our understanding of the factors that may affect children's dietary intake patterns and provide useful insights for developing effective intervention programs to promote healthy eating in young people," said May A. Beydoun, PhD, a co-author of the review, staff scientist at the National Institute on Aging, and a former postdoctoral fellow at the Bloomberg School. "More research is needed to study the parent-child resemblance in the diet, the differences in the association between population groups, and the determinants."

Researchers from the Bloomberg School and leading obesity experts will examine the latest science and policy initiatives for obesity at *Super-Sized World: The Global Obesity Epidemic*.

"Do children and their parents eat a similar diet? Resemblance in child and parental dietary intake: systematic review and meta-analysis" was written by Y Wang, M A Beydoun, J Li, Y Liu, and L A Moreno.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Johns Hopkins University Bloomberg School of Public Health**.

Journal Reference:

1. Y Wang, M A Beydoun, J Li, Y Liu, and L A Moreno. **Do children and their parents eat a similar diet? Resemblance in child and parental dietary intake: systematic review and meta-analysis**. *Journal of Epidemiology and Community Health*, December 2010

http://www.sciencedaily.com/releases/2010/12/101208142257.htm

Lost Civilization Under Persian Gulf?

Antique map of the Persian Gulf. (Credit: iStockphoto/Chad McDermott)

ScienceDaily (Dec. 8, 2010) — A once fertile landmass now submerged beneath the Persian Gulf may have been home to some of the earliest human populations outside Africa, according to an article published in *Current Anthropology*.

Jeffrey Rose, an archaeologist and researcher with the University of Birmingham in the U.K., says that the area in and around this "Persian Gulf Oasis" may have been host to humans for over 100,000 years before it was swallowed up by the Indian Ocean around 8,000 years ago. Rose's hypothesis introduces a "new and substantial cast of characters" to the human history of the Near East, and suggests that humans may have established permanent settlements in the region thousands of years before current migration models suppose.

In recent years, archaeologists have turned up evidence of a wave of human settlements along the shores of the Gulf dating to about 7,500 years ago. "Where before there had been but a handful of scattered hunting camps, suddenly, over 60 new archaeological sites appear virtually overnight," Rose said. "These settlements boast well-built, permanent stone houses, long-distance trade networks, elaborately decorated pottery, domesticated animals, and even evidence for one of the oldest boats in the world."

But how could such highly developed settlements pop up so quickly, with no precursor populations to be found in the archaeological record? Rose believes that evidence of those preceding populations is missing because it's under the Gulf.

"Perhaps it is no coincidence that the founding of such remarkably well developed communities along the shoreline corresponds with the flooding of the Persian Gulf basin around 8,000 years ago," Rose said. "These new colonists may have come from the heart of the Gulf, displaced by rising water levels that plunged the once fertile landscape beneath the waters of the Indian Ocean."

Historical sea level data show that, prior to the flood, the Gulf basin would have been above water beginning about 75,000 years ago. And it would have been an ideal refuge from the harsh deserts surrounding it, with fresh water supplied by the Tigris, Euphrates, Karun, and Wadi Baton Rivers, as well as by underground springs. When conditions were at their driest in the surrounding hinterlands, the Gulf Oasis would have been at its largest in terms of exposed land area. At its peak, the exposed basin would have been about the size of Great Britain, Rose says.

Evidence is also emerging that modern humans could have been in the region even before the oasis was above water. Recently discovered archaeological sites in Yemen and Oman have yielded a stone tool style that is distinct from the East African tradition. That raises the possibility that humans were established on the southern part of the Arabian Peninsula beginning as far back as 100,000 years ago or more, Rose says. That is far earlier than the estimates generated by several recent migration models, which place the first successful migration into Arabia between 50,000 and 70,000 years ago.

The Gulf Oasis would have been available to these early migrants, and would have provided "a sanctuary throughout the Ice Ages when much of the region was rendered uninhabitable due to hyperaridity," Rose said. "The presence of human groups in the oasis fundamentally alters our understanding of human emergence and cultural evolution in the ancient Near East."

It also hints that vital pieces of the human evolutionary puzzle may be hidden in the depths of the Persian Gulf.

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Story Source:

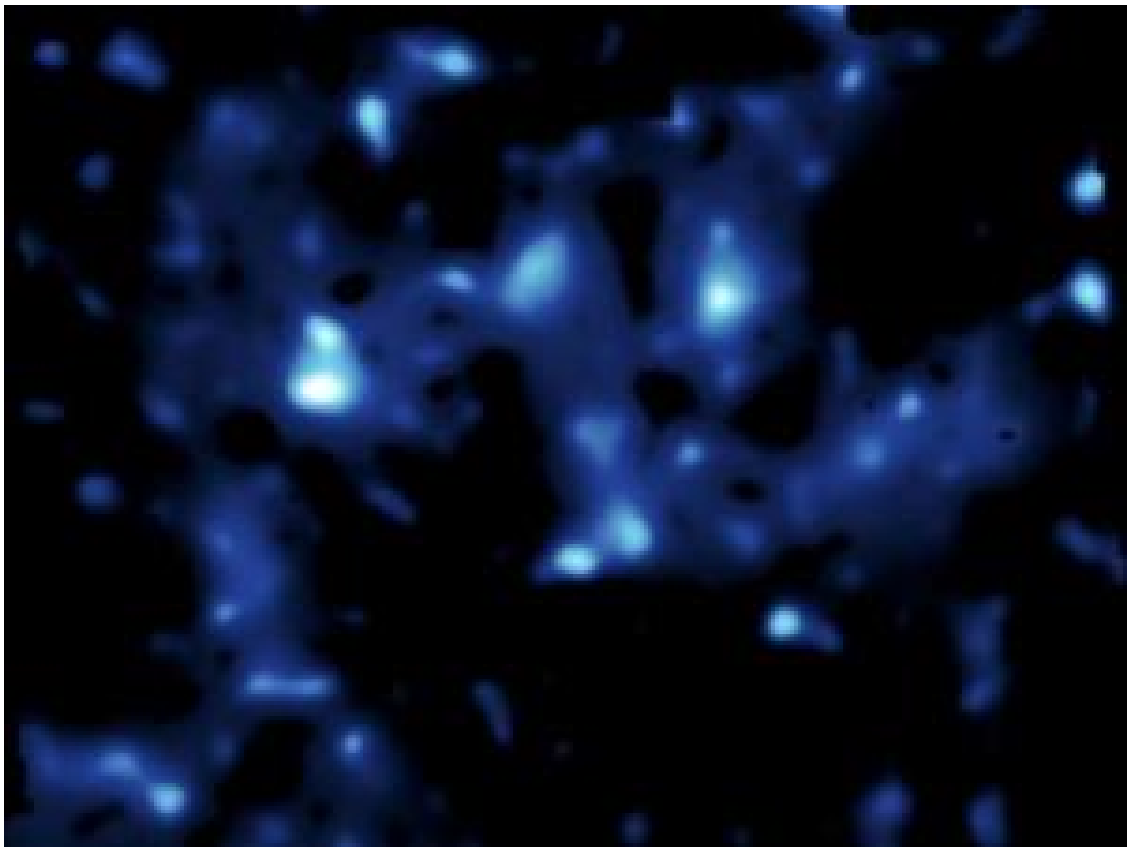
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Chicago Press Journals**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Jeffrey I. Rose. **New Light on Human Prehistory in the Arabo-Persian Gulf Oasis**. *Current Anthropology*, 2010; 51: 6 DOI: 10.1086/657397

http://www.sciencedaily.com/releases/2010/12/101208151609.htm

So You Think You Can Solve a Cosmology Puzzle? Scientists Challenge Other Scientists With a Series of Galaxy Puzzles



This map shows the distribution of dark matter in a portion of our universe. It was created with the help of "weak gravitational lensing" -- a natural phenomenon that occurs when light from distant galaxies is slightly warped by the mass of galaxies and clumps of dark matter in the foreground. (Credit: NASA/ESA/Caltech)

ScienceDaily (Dec. 8, 2010) — Cosmologists have come up with a new way to solve their problems. They are inviting scientists, including those from totally unrelated fields, to participate in a grand competition. The idea is to spur outside interest in one of cosmology's trickiest problems -- measuring the invisible dark matter and dark energy that permeate our universe.

The results will help in the development of new space missions, designed to answer fundamental questions about the history and fate of our universe.

"We're hoping to get more computer scientists interested in our work," said cosmologist Jason Rhodes of NASA's Jet Propulsion Laboratory in Pasadena, Calif., who is helping to organize the challenge, which begins on Dec. 3, 2010. "Some of the mathematical problems in our field are the same as those in machine-learning applications -- for example facial-recognition software."

JPL and several European Universities, including The University of Edinburgh and University College London in the United Kingdom, are helping to support the event, which is funded by a European Union group called Pattern Analysis, Statistical Modelling and Computation Learning. The principal investigator is Thomas Kitching of the University of Edinburgh.

This year, the competition, which has operated since 2008, is called GREAT 2010, after GRavitational lEnsing Accuracy Testing. The challenge is to solve a series of puzzles involving distorted images of galaxies. Occasionally in nature, a galaxy is situated behind a clump of matter that is causing the light from the galaxy to bend. The result is a magnified and skewed image of the galaxy. In the most extreme cases, the warping results in multiple images and even a perfect ring, called an Einstein Ring after Albert Einstein, who predicted the effect. But most of the time, the results are more subtle and a galaxy image is distorted just a tiny bit -- not even enough to be perceived by eye. This is called weak gravitational lensing, or just weak lensing for short.

Weak lensing is a powerful tool for unlocking the fabric of our universe. Only four percent of our universe consists of the stuff that makes up people, stars and anything with atoms. Twenty-four percent is dark matter -- a mysterious substance that we can't see but which tugs on the regular matter we can see. Most of our universe, 72 percent, consists of dark energy, which is even more baffling than dark matter. Dark energy is gravity's nemesis -- where gravity pulls, dark energy pushes. By studying lensed, or distorted, galaxies, scientists can create better maps of dark matter -- and by studying how dark matter changes over time, they can better understand dark energy.

Weak lensing is a promising method for tackling these questions. The 2010 U.S. National Research Council Decadal Survey on astronomy and astrophysics has ranked mission proposals using this method as high priorities.

The GREAT 2010 challenge is designed to improve weak-lensing know-how. Participants will start with fuzzy pictures of galaxies that have been distorted ever so slightly by invisible dark matter parked in front of them. The effect is so small that you can't see it with your eyes. The problem is even trickier because the telescopes are also distorting the galaxy images to an even greater degree than the dark matter. It takes complex techniques -- mathematical models and image-analysis algorithms -- to tease apart these various influences and ultimately discover how dark matter is warping a galaxy's shape.

"This is an image-analysis challenge. You don't need to be an astronomer or cosmologist to help measure the weak-lensing effect," said Kitching. "This challenge is meant to encourage a multidisciplinary approach to the problem."

Participants will have nine months to solve a series of thousands of puzzles. The winners will be announced at a closing ceremony and workshop held at JPL. Prize-winners can expect some kind of cool gadget -- as well as the satisfaction of having brought the world one step closer to understanding what makes our universe tick.

To participate in the venture, in-depth technical information is available online at: http://www.greatchallenges.info .

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Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **NASA/Jet Propulsion Laboratory**.

http://www.sciencedaily.com/releases/2010/12/101207210859.htm

Theoretical Breakthrough: Generating Matter and Antimatter from Nothing

New theoretical research suggests that under just the right conditions -- which involve an ultra-high-intensity laser beam and a two-mile-long particle accelerator -- it could be possible to create something out of nothing. (Credit: iStockphoto/Evgeny Kuklev)

ScienceDaily (Dec. 8, 2010) — Under just the right conditions -- which involve an ultra-high-intensity laser beam and a two-mile-long particle accelerator -- it could be possible to create something out of nothing, according to University of Michigan researchers.

The scientists and engineers have developed new equations that show how a high-energy electron beam combined with an intense laser pulse could rip apart a vacuum into its fundamental matter and antimatter components, and set off a cascade of events that generates additional pairs of particles and antiparticles.

"We can now calculate how, from a single electron, several hundred particles can be produced. We believe this happens in nature near pulsars and neutron stars," said Igor Sokolov, an engineering research scientist who conducted this research along with associate research scientist John Nees, emeritus electrical engineering professor Gerard Mourou and their colleagues in France.

At the heart of this work is the idea that a vacuum is not exactly nothing.

"It is better to say, following theoretical physicist Paul Dirac, that a vacuum, or nothing, is the combination of matter and antimatter -- particles and antiparticles.Their density is tremendous, but we cannot perceive any of them because their observable effects entirely cancel each other out," Sokolov said.

Matter and antimatter destroy each other when they come into contact under normal conditions.

"But in a strong electromagnetic field, this annihilation, which is typically a sink mechanism, can be the source of new particles," Nees said, "In the course of the annihilation, gamma photons appear, which can produce additional electrons and positrons."

A gamma photon is a high-energy particle of light. A positron is an anti-electron, a mirror-image particle with the same properties as an electron, but an opposite, positive charge.

The researchers describe this work as a theoretical breakthrough, and a "qualitative jump in theory."

An experiment in the late '90s managed to generate from a vacuum gamma photons and an occasional electron-positron pair. These new equations take this work a step farther to model how a strong laser field

could promote the creation of more particles than were initially injected into an experiment through a particle accelerator.

"If the electron has a capability to become three particles within a very short time, this means it's not an electron any longer," Sokolov said. "The theory of the electron is based on the fact that it will be an electron forever. But in our calculations, each of the charged particles becomes a combination of three particles plus some number of photons."

The researchers have developed a tool to put their equations into practice in the future on a very small scale using the HERCULES laser at U-M. To test their theory's full potential, a HERCULES-type laser would have to be built at a particle accelerator such as the SLAC National Accelerator Laboratory at Stanford University. Such infrastructure is not currently planned.

This work could potentially have applications in inertial confinement fusion, which could produce cleaner energy from nuclear fusion reactions, the researchers say.

To Sokolov, it's fascinating from a philosophical perspective.

"The basic question what is a vacuum, and what is nothing, goes beyond science," he said. "It's embedded deeply in the base not only of theoretical physics, but of our philosophical perception of everything -- of reality, of life, even the religious question of could the world have come from nothing."

A paper on this work is published in *Physical Review Letters*.

Sokolov is a research scientist at the Space Physics Research Laboratory in the Department of Atmospheric, Oceanic and Space Sciences. Nees is an associate research scientist at the Center for Ultrafast Optical Science and an adjunct associate professor in the Department of Electrical Engineering and Computer Science. Mourou is the A.D. Moore Distinguished University Professor Emeritus of Electrical Engineering who is currently with the Institut de la Lumiere Extreme in France. Also contributing is Natalia M. Naumova, with the Laboratoire d'Optique Appliquee in France.

This research was supported in part by the Department of Energy.

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

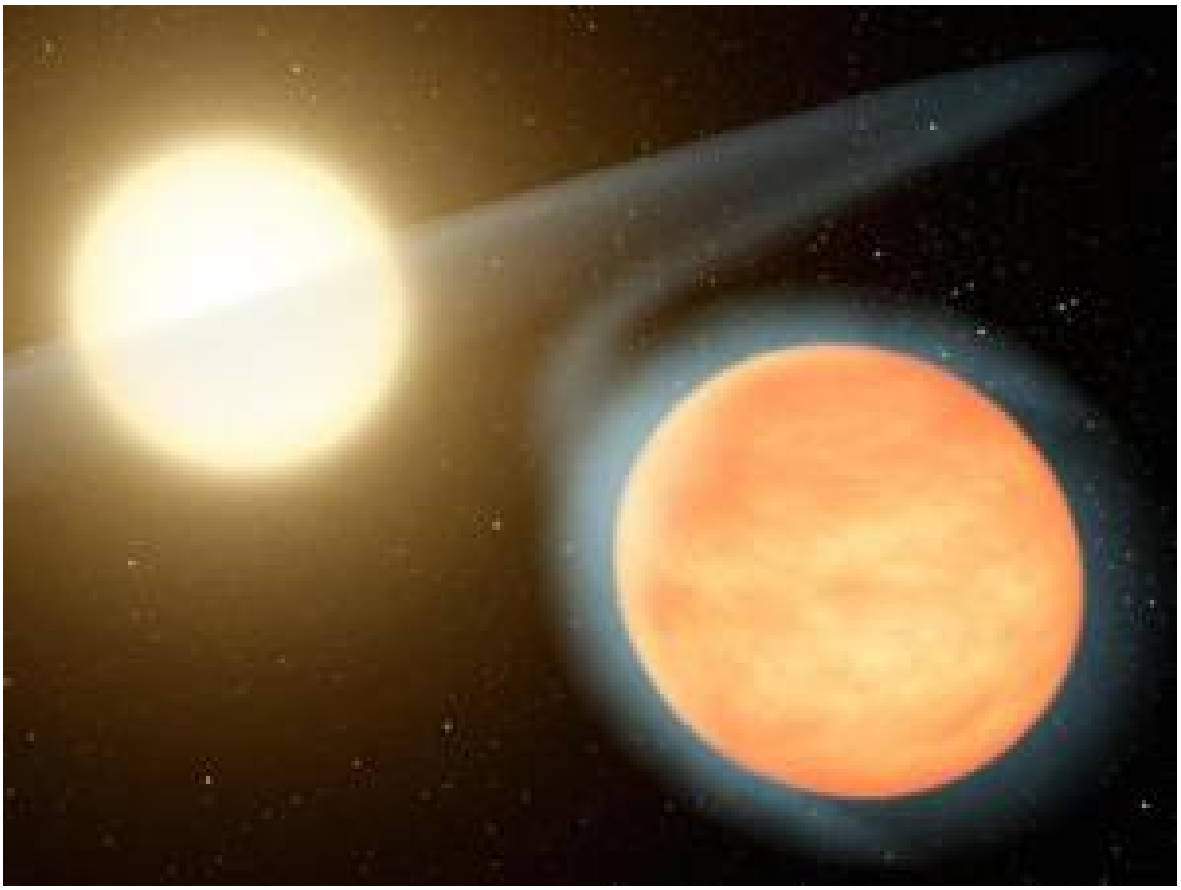
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of Michigan**.

Journal Reference:

1. Igor Sokolov, Natalia Naumova, John Nees, Gérard Mourou. **Pair Creation in QED-Strong Pulsed Laser Fields Interacting with Electron Beams**. *Physical Review Letters*, 2010; 105 (19) DOI: 10.1103/PhysRevLett.105.195005

http://www.sciencedaily.com/releases/2010/12/101208130038.htm

Astronomers Detect First Carbon-Rich Exoplanet



This artist's concept shows the searing-hot gas planet WASP-12b (orange orb) and its star. NASA's Spitzer Space Telescope discovered that the planet has more carbon than oxygen, making it the first carbon-rich planet ever observed. (Credit: NASA/JPL-Caltech)

ScienceDaily (Dec. 8, 2010) — A team led by a former postdoctoral researcher in MIT's Department of Earth, Atmospheric and Planetary Sciences and the MIT Kavli Institute for Astrophysics, recently measured the first-ever planetary atmosphere that is substantially enriched in carbon. The researchers found that the carbon-to-oxygen ratio of WASP-12b, an exoplanet about 1.4 times the mass of Jupiter and located about 1,200 light years away, is greater than one. As they report in a paper to be published on Dec. 8 in *Nature*, this carbon-rich atmosphere supports the possibility that rocky exoplanets could be composed of pure carbon rocks like diamond or graphite rather than the silica-based rock found in Earth.

"This is new territory and will motivate researchers to study what the interiors of carbon-rich planets could be made of," says lead author Nikku Madhusudhan, who is now a postdoctoral researcher at Princeton University. Although WASP-12b is a "hot Jupiter," or a Jupiter-sized, extremely hot exoplanet, that is largely made of gas and has no surface to host life, the first-ever finding of a carbon-rich exoplanet is significant because it introduces an entirely new class of exotic exoplanets to explore. It's also possible that rockier, Earth-sized exoplanets may have formed around the same star as WASP-12b billions of years ago. If detected, these smaller planets could also have carbon-rich atmospheres and interiors, meaning that for life to exist on these planets, it might have to survive with very little water and oxygen, and plenty of methane, says Madhusudhan. That might not be so far-fetched given the recent announcement by NASA of the discovery on Earth of bacteria that can survive in arsenic, a poison to humans.

Astronomers can figure out a planet's atmospheric composition by observing its flux, or the light emitted by the planet, at different wavelengths. The team, coordinated by Joe Harrington, a planetary scientist at the University of Central Florida, used NASA's Spitzer Space Telescope to observe the flux from WASP-12b, at four wavelengths, right before it passed behind the star, an event known as secondary eclipse. Those observations were then combined with previously published observations, at three other wavelengths, obtained from Earth using the Canada-France-Hawaii Telescope in Hawaii. The planet was discovered in 2009 by researchers at the United Kingdom-based consortium for Wide Angle Search for Planets (WASP), who are also coauthors of the study.

Madhusudhan used the observations to conduct a detailed atmospheric analysis using a modeling technique he pioneered for exoplanetary atmospheres. The computer program he developed combines certain variables, such as a planet's temperature distribution, with different amounts of the most prominent molecules that exist in such atmospheres, which are methane, carbon dioxide, carbon monoxide, water vapor and ammonia, into one formula that produces a theoretical spectrum, or flux at different wavelengths. The program analyzes millions of combinations of these variables, tracking those that most closely match the flux values measured by the telescopes. Through statistical analysis of these values, Madhusudhan can determine the most likely composition of the atmosphere.

Based on theories about what extremely hot Jupiters such as WASP-12b should look like, assuming carbon-to-oxygen ratios of 0.5, previous models suggested that their atmospheres should have plenty of water vapor, very little methane and an atmospheric layer known as a stratosphere. Instead, Madhusudhan's team detected an atmosphere with more than 100 times excess methane and less water than had been expected. The observed composition is consistent with a carbon-to-oxygen ratio that is greater than one. The team also discovered the lack of a strong stratosphere, which contradicts existing theories of hot Jupiter atmospheres.

The discovery suggests that chunks of rock called planetesimals that slammed together to form WASP-12b billions of years ago may have been made of carbon-rich compounds like tar -- a far cry from the watery, icy planetesimals that are thought to have formed the solar-system planets. This means that if smaller exoplanets are found to have carbon-rich atmospheres, their surfaces could be covered in a tar-like substance. Future research will investigate whether life -- perhaps drastically different from life as we know it -- could survive in such a carbon-rich environment.

"It's exciting to even think about the possibility" of what carbon-rich planets could look like, says Adam Showman, a planetary scientist at the University of Arizona, who explains that although researchers knew that other solar systems should have a range of carbon-to-oxygen values, "this paper finally moves the discussion from pure speculation to plausible reality." He notes that exoplanets with carbon-based interiors could exhibit a range of surface features, atmospheric compositions and potential for oceans or life.

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Story Source:

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 Morgan Bettex, MIT News Office.

Journal Reference:

1. Nikku Madhusudhan, Joseph Harrington, Kevin B. Stevenson, Sarah Nymeyer, Christopher J. Campo, Peter J. Wheatley, Drake Deming, Jasmina Blecic, Ryan A. Hardy, Nate B. Lust, David R. Anderson, Andrew Collier-Cameron, Christopher B. T. Britt, William C. Bowman, Leslie Hebb, Coel Hellier, Pierre F. L. Maxted, Don Pollacco, Richard G. West. **A high C/O ratio and weak thermal inversion in the atmosphere of exoplanet WASP-12b**. *Nature*, 2010; DOI: 10.1038/nature09602

http://www.sciencedaily.com/releases/2010/12/101208132212.htm

Blueberries and Other Purple Fruits to Ward Off Alzheimer's, Multiple Sclerosis and Parkinson's

Eating purple fruits such as blueberries and drinking green tea can help ward off diseases including Alzheimer's, Multiple Sclerosis and Parkinson's, a University of Manchester report claims. (Credit: iStockphoto/Jack Puccio)

ScienceDaily (Dec. 8, 2010) — Eating purple fruits such as blueberries and drinking green tea can help ward off diseases including Alzheimer's, Multiple Sclerosis and Parkinson's, a University of Manchester report claims.

New research from Professor Douglas Kell, published in the journal *Archives of Toxicology*, has found that the majority of debilitating illnesses are in part caused by poorly-bound iron which causes the production of dangerous toxins that can react with the components of living systems.

These toxins, called hydroxyl radicals, cause degenerative diseases of many kinds in different parts of the body.

In order to protect the body from these dangerous varieties of poorly-bound iron, it is vital to take on nutrients, known as iron chelators, which can bind the iron tightly.

Brightly-coloured fruits and vegetables are excellent sources of chelators, as is green tea, with purple fruits considered to have the best chance of binding the iron effectively .

However, despite conflicting reports, the widely-publicised benefits of red wine seem to work in a different way, and have no similar benefits, Professor Kell's paper noted.

This new paper is the first time the link has been made between so many different diseases and the presence of the wrong form of iron, and gives a crucial clue as to how to prevent them or at least slow them down.

Professor Kell argues that the means by which poorly-liganded iron accelerates the onset of debilitating diseases shows up areas in which current, traditional thinking is flawed and can be dangerous.

For instance, Vitamin C is thought to be of great benefit to the body's ability to defend itself against toxins and diseases.

However Professor Kell, who is Professor of Bioanalytical Science at the University, indicates that excess vitamin C can in fact have the opposite effect to that intended if unliganded iron is present.

Only when iron is suitably and safely bound ("chelated") will vitamin C work effectively.

Professor Kell said: "Much of modern biology has been concerned with the role of different genes in human disease.

"The importance of iron may have been missed because there is no gene for iron as such. What I have highlighted in this work is therefore a crucial area for further investigation, as many simple predictions follow from my analysis.

"If true they might change greatly the means by which we seek to prevent and even cure such diseases."

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

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Story Source:

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

Journal Reference:

1. Douglas B. Kell. **Towards a unifying, systems biology understanding of large-scale cellular death and destruction caused by poorly liganded iron: Parkinson's, Huntington's, Alzheimer's, prions, bactericides, chemical toxicology and others as examples**. *Archives of Toxicology*, 17 August 2010 DOI: 10.1007/s00204-010-0577-x

http://www.sciencedaily.com/releases/2010/12/101208083541.htm

New Observations of Exploding Stars Reveal Pauses, Flickers and Flares Not Reliably Seen Before

Artist's impression of the central system of the recurrent nova RS Oph early in its 2006 outburst. Hydrogen-rich material from the Red Giant falls onto the surface of its companion White Dwarf, ultimately leading to a runaway thermonuclear explosion. Ejecta traveling at several thousand kilometers per second slam into the wind of the Red Giant setting up shocks with temperatures more than 10 times that in the core of the Sun. A decade or so later another nova explosion will occur. RS Oph is one of the objects proposed to end its life as a Type Ia supernova. (Credit: Image courtesy of STFC and David Hardy)

ScienceDaily (Dec. 8, 2010) — Astronomers have traced the waxing and waning light of exploding stars more closely than ever before and seen patterns that aren't yet accounted for in our current understanding of how these eruptions occur.

Using data from a sensitive instrument aboard a satellite that images the entire sky every 102 minutes, they studied four of these stars, or novae, that exploded so violently their light would have been visible without a telescope and measured their brightness over the course of the outburst.

Three of the novae stalled before reaching a peak, and all flickered or flared as the explosions ran their course, they report in *The Astrophysical Journal*.

The instrument they used -- the Solar Mass Ejection Imager -- was developed by a team led by astrophysicist Bernard Jackson at the Center for Astrophysics and Space Sciences at the University of California, San

Diego, to study the sun. Rebekah Hounsell, a graduate student at Liverpool John Moores University in Britain made the measurements while visiting UC San Diego.

Because starlight is a distraction for Jackson's team, noise they must subtract from their data so that they can focus on the sun's outer corona and the heliosphere, they make detailed maps of stellar light, including its brightness.

In those maps Hounsell identified the four novae by finding points of light that rapidly brightened and dimmed over the course of days.

Wavering Light

Other astronomers had observed a pause in the brightening of novae, or "pre-maximum halt" before, but some thought it an anomaly. The precise time-scale and repeated observations of the current study confirms it, they authors say.

"The reality of this halt as found in all three of the fast-declining novae observed is a challenge to detailed models of the nova outburst," said one of the authors, astrophysicist Mike Bode, of Liverpool John Moores University.

Two independent teams of theorists have already begun to refine their models of how novae explode in response.

Astronomers typically characterize novae's changing light with curves smoothly fit to more sporadic observations, but the rapid cadence of the solar imager captured glimmers that hadn't been observed before. All flickered as their light dimmed and one nova, the slowest of the four to dim, flared brightly twice after reaching its peak luminosity.

These novae are white dwarf stars that steal matter, in the form of hydrogen, from a companion star, often an aging, expanding red giant. As hydrogen accumulates the white dwarf's gravity pulls it in and condenses it until it ignites, setting off a runaway nuclear fusion reaction.

The team speculates that the post-peak flares may correspond to changes in the dynamics of that reaction that still need to be explained.

Catching Missing Stars

"Before Hounsell looked through these data, most novae were observed only after their peak luminance. The instrument's very even cadences and uniformly exposed images allow us to trace the entire evolution of these explosions as they brighten and dim," UC San Diego's Jackson said.

Data from the imager, which has been in operation aboard the Coriolis satellite since January 2003, allows astronomers to measure novae that they initially missed.

"Even today novae are mainly discovered by amateur astronomers around the world who then alert their professional counterparts to conduct observations," Hounsell said.

As many as five novae bright enough to be detected by SMEI explode in our galaxy each year, Allen Shafter, astronomy professor at San Diego State University and one of the co-authors of the report have previously estimated, but more than half have gone undetected.

"The instrument assures that the brightest and most rapidly evolving novae -- ones that brighten and then fade within a few days -- are not overlooked," Shafter said. "The high time resolution of these observations has opened up a new window into the study of novae in our galaxy."

Bernard Jackson's research at UC San Diego is supported by the National Science Foundation and NASA. Allen Shafter's work at San Diego State University is supported by the National Science Foundation.

Story Source:

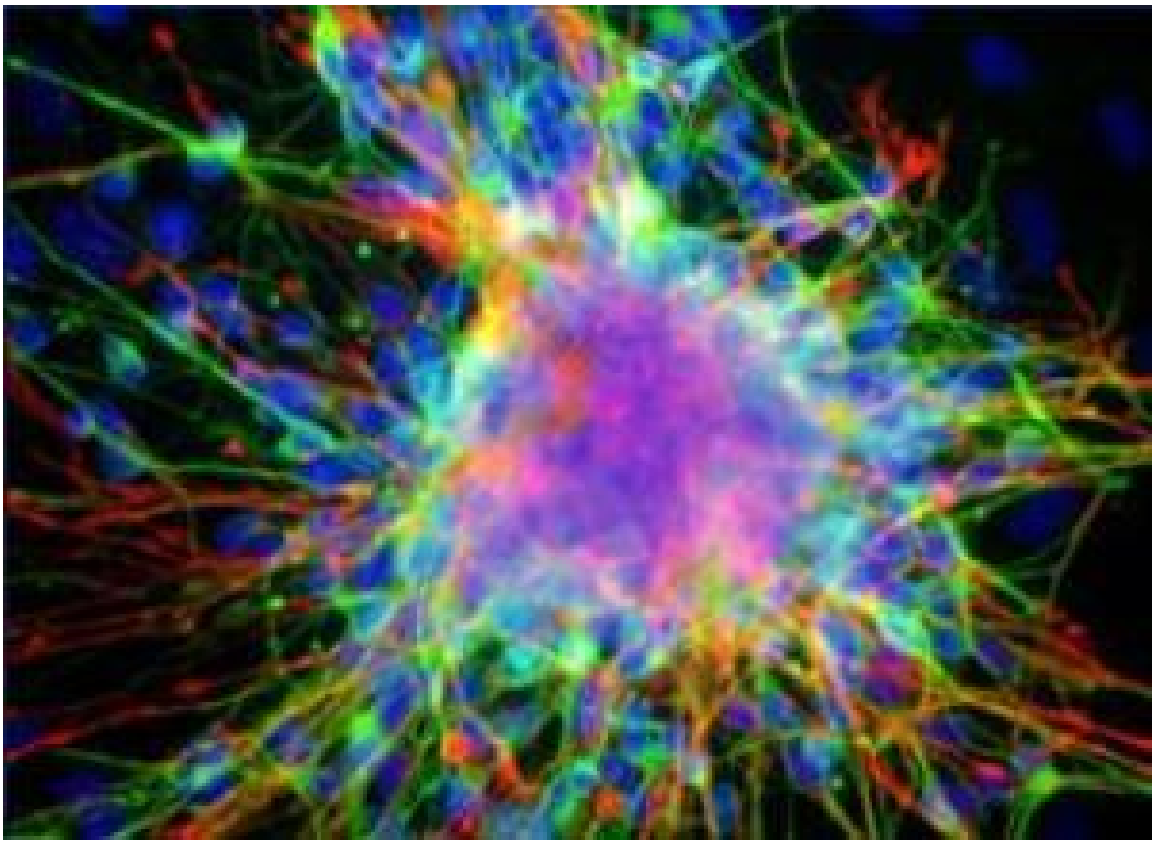
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **University of California - San Diego**. The original article was written by Susan Brown.

Journal Reference:

1. R. Hounsell, M. F. Bode, P. P. Hick, A. Buffington, B. V. Jackson, J. M. Clover, A. W. Shafter, M. J. Darnley, N. R. Mawson, I. A. Steele, A. Evans, S. P. S. Eyres, T. J. O'Brien. **Exquisite Nova Light Curves from the Solar Mass Ejection Imager (SMEI)**. *The Astrophysical Journal*, 2010; 724 (1): 480 DOI: 10.1088/0004-637X/724/1/480

http://www.sciencedaily.com/releases/2010/12/101203163044.htm

Stem Cell Advance a Step Forward for Treatment of Brain Diseases



These neurons, oligodendrocytes and astrocytes were derived from a single human neural stem cell. (Credit: Image courtesy of University of Rochester Medical Center)

ScienceDaily (Dec. 8, 2010) — Scientists have created a way to isolate neural stem cells -- cells that give rise to all the cell types of the brain -- from human brain tissue with unprecedented precision, an important step toward developing new treatments for conditions of the nervous system, like Parkinson's and Huntington's diseases and spinal cord injury.

The work by a team of neuroscientists at the University of Rochester Medical Center was published in the Nov. 3 issue of the *Journal of Neuroscience*. Neurologist Steven Goldman, M.D., Ph.D., chair of the Department of Neurology, led the team.

The latest paper marks a six-year effort by Goldman's team to develop a better way to isolate pure preparations of neural stem cells directly from the human brain. These stem cells can renew themselves and have the potential to become a number of brain cell types -- for instance, oligodendrocytes that might help people with multiple sclerosis, or neurons to help people with Parkinson's disease. But after the first few months of human embryonic development, they become rare in the brain, and it's challenging for scientists to find, isolate and manipulate them. Yet those challenges must be met if stem cells are to live up to their promise as treatments for a host of human diseases of the nervous system.

So far, most efforts aimed at isolating human fetal stem cells have entailed cultivating brain tissue in tissue culture in the laboratory for months, then separating out the stem cells for study. In addition, today's techniques don't separate out just stem cells; typically, similar cells known as progenitor cells, which have

already committed to becoming a certain type of cell, are also captured. The difference is crucial for scientists who often prefer to capture only uncommitted neural stem cells, whether to treat brain diseases requiring the replacement of multiple cell types or to better understand their function.

The Goldman lab's new technique snags only neural stem cells and does so directly from brain tissue. The technology saves months of time and labor in the laboratory and also gives scientists a clearer look than ever before at exactly how stem cells operate in the brain.

In its studies, Goldman's team found some surprises. As expected, certain classes of genes encoding for proteins active in mouse neural stem cells -- such as members of the *Notch and WNT* families -- were highly active. But when the scientists looked more closely, they found that the freshly isolated neural stem cells expressed some genes from these families that were previously virtually unknown in humans, and which had never before been implicated in human brain function. At the same time, some of the genes that are important and active in mouse neural stem cells proved not to be so in the human cells.

"While research in mice and other animals serves as a guide, ultimately you have to study human tissue and humans to really understand disease in people," said Goldman, who is also co-director of Rochester's Center for Translational Neuromedicine. "While the general signaling pathways active in mice and people are very similar, the individual genes are quite different. This is not something we would have predicted. It's a good demonstration that you can't use mouse studies to fully dictate what kinds of therapeutics should be used in people."

The ability to gather human cells more efficiently should aid potential treatments built around transplanting stem cells. In the last few years a couple studies using human neural stem cells in the nervous system have begun in children with incurable brain diseases known as pediatric leukodystrophies. But the field is in its infancy, and Goldman believes that the cell types currently being used will soon be replaced by more effective types of transplantable stem and progenitor cells.

The new technology is built around a piece of DNA that codes for a protein known as Sox2, which has long been recognized as a key stem cell gene. Since the gene is active only in stem cells, finding a way to see and isolate cells with an active Sox2 gene is the key.

To track it down, the team identified the DNA sequence, known as an enhancer, that determines whether Sox2 is active in neural stem cells. The scientists took that piece of DNA, coupled it to a gene that makes cells emit light of a particular wavelength, and then packaged the resulting synthetic DNA into a virus. They used the virus to deliver the synthetic DNA to neural stem cells in the brain tissue. The technique compelled neural stem cells -- and only the stem cells -- to emit light of a certain color, which in turn allowed a laser-based system to tag and capture just those cells. The result was a pure population of human neural stem cells, the first such population ever purified so specifically or directly.

His co-authors on the paper are its first author, Su Wang, Ph.D., assistant professor of Neurology; Devin Chandler-Militello, senior technical associate; and Fraser Sim, Ph.D., assistant professor of Neurology at URMC, who recently established his own laboratory at the University of Buffalo. Other authors from the University include Gang Lu, Alex Zielke, Romane Auvergne, and Nancy Stanwood, M.D., associate professor of Obstetrics and Gynecology. Also contributing were Neeta Roy of Cornell University, Daniel Geschwind and Giovanni Coppola of the University of California at Los Angeles, and Silvia Nicolis of the University of Milano-Bicocca in Italy.

The work was supported by the Adelson Medical Research Foundation, the Mathers Charitable Foundation, the James S. McDonnell Foundation, the New York State Stem Cell Science Board, and the National Institute of Neurological Disorders and Stroke.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

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Journal Reference:

1. S. Wang, D. Chandler-Militello, G. Lu, N. S. Roy, A. Zielke, R. Auvergne, N. Stanwood, D. Geschwind, G. Coppola, S. K. Nicolis, F. J. Sim, S. A. Goldman. **Prospective Identification, Isolation, and Profiling of a Telomerase-Expressing Subpopulation of Human Neural Stem Cells, using sox2 Enhancer-Directed Fluorescence-Activated Cell Sorting**. *Journal of Neuroscience*, 2010; 30 (44): 14635 DOI: 10.1523/JNEUROSCI.1729-10.2010

http://www.sciencedaily.com/releases/2010/12/101207131733.htm

Second-Hand Smoke Increases Risk of Invasive Meningococcal Disease in Children

ScienceDaily (Dec. 8, 2010) — Children exposed to second-hand smoke are more likely to get invasive meningococcal disease than children who are not exposed, reports a study from Chien-Chang Lee at the Harvard School of Public Health (Boston, USA) and colleagues published in this week's *PLoS Medicine*. The authors also found a possible association of second-hand smoke exposure with invasive pneumococcal disease and Haemophilus influenzae type b.

By reviewing and analysing published studies (30 case-control and 12 cross-sectional studies, mostly conducted in high income countries with good vaccination policies), the authors used the findings of all studies that had compared the occurrence of invasive bacterial disease in children exposed to second-hand smoke with its occurrence in children not exposed to second-hand smoke.

The authors found that exposure to second-hand smoke doubled the likelihood of invasive meningococcal disease (with a total odds ratio for second hand smoke exposure of 2.02) and although there was an increase in the risk of developing invasive pneumococcal disease and Haemophilus influenzae type b, this increase could not be distinguished from chance finding, perhaps because a relatively small number of studies were available. However, nasal carriage of N. meningitidis (which causes meningitis) and S. pneumoniae in children exposed to second-hand smoke was significantly increased compared to those who were not exposed. The effects were generally stronger in the youngest children, those below 6 years of age, who are more vulnerable.

These results suggest that by decreasing children's exposure to second-hand smoke, for example by parents stopping smoking or not smoking at home, deaths and illness caused by invasive bacterial diseases could be reduced. Such a reduction would be particularly beneficial in poor countries, where vaccination against invasive bacterial diseases is low.

The authors conclude: "Because the burden of invasive bacterial disease is highest in developing countries where second-hand smoke is increasing, there is a need for high-quality studies to confirm these results, and for interventions to reduce exposure of children to second-hand smoke."

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

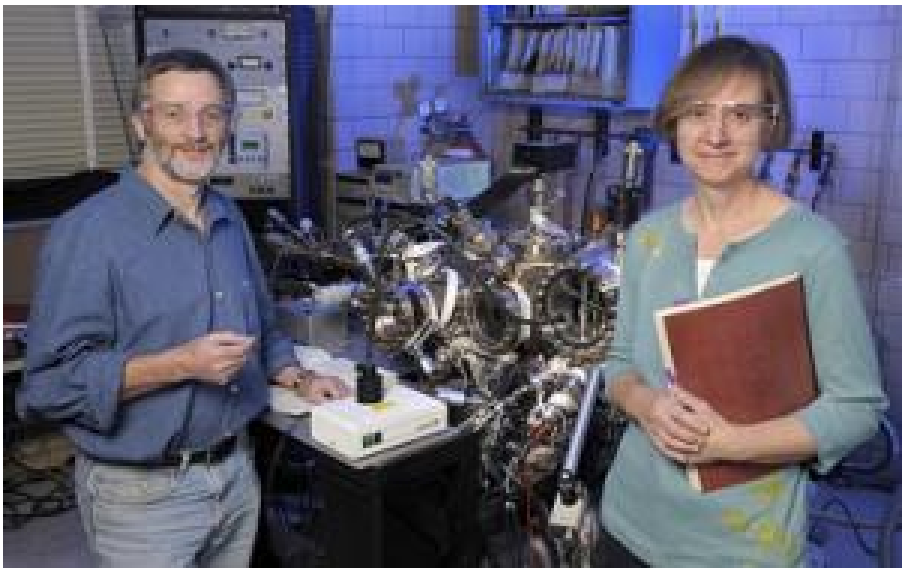
The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by **Public Library of Science**, via EurekAlert!, a service of AAAS.

Journal Reference:

1. Bruce P. Lanphear, Chien-Chang Lee, Nicole A. Middaugh, Stephen R. C. Howie, Majid Ezzati. **Association of Secondhand Smoke Exposure with Pediatric Invasive Bacterial Disease and Bacterial Carriage: A Systematic Review and Meta-analysis**. *PLoS Medicine*, 2010; 7 (12): e1000374 DOI: 10.1371/journal.pmed.1000374

http://www.sciencedaily.com/releases/2010/12/101207191439.htm

Chemical Coarsening: How the Big Get Bigger



James Evans and Patricia Thiel of Iowa State University and the U.S. Department of Energy's Ames Laboratory are using scanning tunneling microscope technology to study a process called coarsening. (Credit: Photo by Bob Elbert)

ScienceDaily (Dec. 8, 2010) — Patricia Thiel of Iowa State University and the Ames Laboratory put a box of tissues to the right, a stack of coasters to the middle and a trinket box to the left.

"Nature," she said of her table-top illustration, "doesn't want lots of little things." So Thiel grabbed the smaller things and slid them into a single pile next to the bigger tissue box. "Nature wants one big thing all together, like this."

Thiel, an Iowa State Distinguished Professor of Chemistry and a faculty scientist for the U.S. Department of Energy's Ames Laboratory, and James Evans, an Iowa State professor of physics and astronomy and a faculty scientist for the Ames Laboratory, describe that process in the Oct. 29 issue of the journal *Science*.

The paper, "A Little Chemistry Helps the Big Get Bigger," is in the journal's Perspectives section. It describes a process called coarsening. That's when "a group of objects of different sizes transforms into fewer objects with larger average size, such that 'the big get bigger,'" says the paper. Examples of the process include the geologic formation of gemstones, the degradation of pharmaceutical suspensions and the manufacture of structural steels.

Thiel and Evans were invited to write the paper after Thiel delivered a talk at an American Chemical Society meeting about their studies of coarsening, an emerging field in surface chemistry.

Thiel worked with Mingmin Shen, a former Iowa State doctoral student who is now a post-doctoral research associate at Pacific Northwest National Laboratory in Richland, Wash., on the experimental side of the coarsening research. Evans worked with Da-Jiang Liu, an associate scientist at the Ames Laboratory, on the theoretical side of the project.

The researchers, with the support of grants from the National Science Foundation, have been using scanning tunneling microscope technology -- an instrument that allows them to see individual atoms -- to study how coarsening happens on the surface of objects.

They've studied nanoscale particles grown on the surface of silver and how adding sulfur can increase coarsening. They're trying to learn the mechanism of that increase and understand the nature of the messengers that move atoms during the coarsening process.

What Thiel and Evans are looking for is a general principle that explains what they call additive-enhanced coarsening. To do that, Thiel said they still need to collect and analyze data from more coarsening systems.

Evans said a better understanding of the coarsening process can help researchers develop small structures -- including nanoscale technologies, catalysts or drug suspensions -- that resist coarsening and are therefore more durable. A better understanding could also help researchers manipulate coarsening to develop structures with a very narrow distribution of particle sizes, something important to some nanotechnologies.

"When we're building something on a small scale, for it to be useful, it has to be robust, it has to survive," Evans said. "And one thing we're looking at is the stability of the very tiny structures that are crucial to nanoscale technologies.

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

Story Source:

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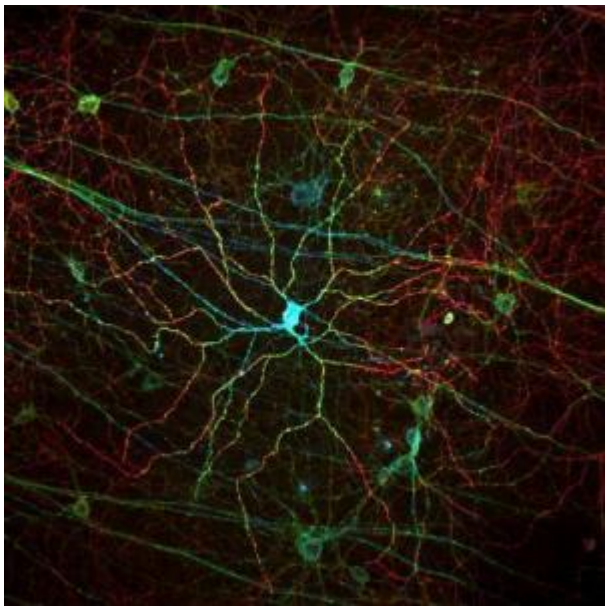
Journal Reference:

1. James W. Evans and Patricia A. Thiel. **A Little Chemistry Helps the Big Get Bigger**. *Science*, 29 October 2010 330: 599-600 DOI: 10.1126/science.1191665

http://www.sciencedaily.com/releases/2010/11/101104154332.htm

New Way of Seeing Discovered: Melanopsin-Expressing Cells Sense Brightness



Melanopsin, a light receptor that measures the intensity of incoming light is found in rare, specialized cells embedded in the retina. The different colors corresponds to different depths of the imaged tissue sample. (Credit: Courtesy of Dr. Satchin Panda, Salk Institute for Biological Studies and Dr. James Fitzpatrick, Waitt Advanced Biophotonics Center)

ScienceDaily (Dec. 8, 2010) — Better known as the light sensor that sets the body's biological clock, melanopsin also plays an important role in vision: Via its messengers-so-called melanopsin-expressing retinal ganglion cells, or mRGCs-it forwards information about the brightness of incoming light directly to conventional visual centers in the brain, reports an international collaboration of scientists in this week's issue of *PLoS Biology*.

The findings reveal a new role for mRGCs during image-forming vision and suggest that these cells could make a significant contribution to assessing the intensity of light and supporting vision even in people with advanced retinal degeneration, the researchers say.

"Millions of people worldwide suffer varying degrees of blindness because of rod and cone degeneration or dysfunction, but many of them can still perceive differences in brightness," says senior author Satchidananda (Satchin) Panda, Ph.D., an assistant professor in the Regulatory Biology Laboratory at the Salk Institute for Biological Studies. "Melanopsin-expressing RGCs typically survive even complete rod and cone loss and could explain the light responses under these conditions," he adds.

For the greater part of 100 years, it was thought that the ability to convert light into electrical signals in the mammalian retina was restricted to only two types of photoreceptors: rods and cones. This view changed dramatically when Panda discovered the existence of a third type of mammalian photoreceptor, which is only present in a few thousand cells embedded in the deeper layers of the retina.

Melanopsin, a photopigment that measures the intensity of incoming light, is fundamentally different from the classical rod and cone opsins, which help us see. For one, it is much less sensitive to light and has far less spatial resolution-characteristics that fit perfectly with this light sensor's primary function of signaling changes in ambient light levels to the brain throughout the day.

It sends its signals directly to the human circadian clock, which sits just above the point where the optic nerves cross. Although only half the size of a pencil eraser, it synchronizes the body's daily rhythms with the rising and setting of the sun, telling the body when it is time to go to sleep, when to be hungry and when to wake up. But it does more than that. Just like a meter in a camera that allows the aperture to be adjusted, mRGCs also control pupil size.

Until now, however, it was unknown whether mRGCs also contribute to conventional image-forming vision, especially the as-yet poorly understood mechanism of "brightness" and "lightness" perception.

To find out, Panda and his collaborators at the University of Manchester traced individual mRGCs' axons -- long, slender projections that connect with other neurons -- from the retina through the circadian clock and onward. They discovered that the axons reached all the way to the LGN, short for lateral geniculate nucleus, the primary processing center for visual information received from the retina.

"We found widespread light responses in the LGN and visual cortex, even in mice lacking functional rods and cones, which are often used as a model of advanced retinal degeneration," says Panda, who hopes that one day it might be possible to impart vision to blind individuals by gene therapy with a re-engineered melanopsin.

"The density of mRGCs in the retina is too low for any meaningful resolution," he says. "But if we could express melanopsin in a greater number of cells, we might be able to increase resolution to a point that allows blind people to safely navigate their environment."

Researchers who also contributed to the work include Timothy M. Brown, John Gigg and Robert J. Lucas at the University of Manchester, Manchester, United Kingdom; Carlos Gias, Ma'ayan Semo and Peter J. Coffey at University College London, London, United Kingdom; as well as Megumi Hatori, and Sheena Rachel Keding at the Salk Institute for Biological Studies in La Jolla.

The work was funded by grants from the Wellcome Trust, the National Institutes of Health, the Dana Foundation, a Pew Scholar award and the London Project to Cure Blindness.

***Disclaimer**: This article is not intended to provide medical advice, diagnosis or treatment. Views expressed here do not necessarily reflect those of ScienceDaily or its staff.*

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Journal Reference:

1. Fred Rieke, Timothy M. Brown, Carlos Gias, Megumi Hatori, Sheena R. Keding, Ma'ayan Semo, Peter J. Coffey, John Gigg, Hugh D. Piggins, Satchidananda Panda, Robert J. Lucas. **Melanopsin Contributions to Irradiance Coding in the Thalamo-Cortical Visual System**. *PLoS Biology*, 2010; 8 (12): e1000558 DOI: 10.1371/journal.pbio.1000558

http://www.sciencedaily.com/releases/2010/12/101207191441.htm

Creating 'Living' Buildings

Protocell drivers in flask at the Venice Architecture Biennale 2010. (Credit: Image courtesy of University of Greenwich)

ScienceDaily (Dec. 8, 2010) — The University of Greenwich's School of Architecture & Construction is poised to use ethical synthetic biology to create 'living' materials that could be used to clad buildings and help combat the effects of climate change.

Researchers from the University of Greenwich are collaborating with others at the University of Southern Denmark, University of Glasgow and University College London (UCL) to develop materials that could eventually produce water in desert environments or harvest sunlight to produce biofuels.

In collaboration with an architectural practice and a building materials' manufacturer, the idea is to use protocells -- bubbles of oil in an aqueous fluid sensitive to light or different chemicals -- to fix carbon from the atmosphere or to create a coral-like skin, which could protect buildings.

Professor Neil Spiller, an architect and the new head of the University of Greenwich's School of Architecture & Construction, said the research team was looking at methods of using responsive protocells to clad cities in an ethical, green and sustainable way.

"We want to use ethical synthetic biology to create large-scale, real world applications for buildings," he says.

Protocells made from oil droplets in water allow soluble chemicals to be exchanged between the drops and their surrounding solution.

The Center for Fundamental Living Technology at the University of Southern Denmark has managed to get cells to capture carbon dioxide from solution and convert it into carbon-containing materials. Such cells could be used to fix carbon to create ways of building carbon-negative architecture.

An installation displayed in the Canadian Pavilion in the Venice Biennale 2010, Hylozoic Ground, created by Canadian architect Philip Beesley, provides an example of how protocells may be used to create carbon-negative architectures. Protocells situated within the installation designed by Dr Rachel Armstrong, Teaching Fellow at UCL's Bartlett School of Architecture, recycle carbon dioxide exhaled by visitors into carbon-containing solids. Similar deposits could be used to stabilise the city's foundations by growing an artificial limestone reef beneath it.

"We want to use protocell bubbles to fix carbon or precipitate skin that we can then develop into a coral-like architecture, which could petrify the piles that support Venice to spread the structural weight-load of the city," Professor Spiller said.

Under Professor Spiller's leadership, Greenwich's School of Architecture & Construction is bringing a host of new technologies -- such as nano, digital and synthetic biology technologies -- into architectural practice.

***Disclaimer**: Views expressed in this article do not necessarily reflect those of ScienceDaily or its staff.*

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http://www.sciencedaily.com/releases/2010/11/101105085428.htm

A Curricular Innovation, Examined

- December 16, 2010

It was the fall of 2010, and I was taking an introductory macroeconomics course. As I sat at my computer clicking through the lesson presentation for Chapter Eight: Basic Macroeconomic Relationships, my eye was caught by a "Real World Example":

"Is the U.S. housing market out of equilibrium? For a current example of equilibrium in action, read 'Housing Bubble — or Bunk? Are home prices soaring unsustainably and due for plunge? A group of experts takes a look — and come to very different conclusions.' Keep the housing market in mind as you go through this topic, and use your new knowledge to draw your own conclusions."

The blurb linked to a *Business Week* article dated June 22, 2005.

Few professors of economics would argue with the idea that it's important to relate the material in a macroeconomics course to events both current and historical. But what kind of professor would tie his class lessons to economic news more than five years out of date -- and now painfully ironic to boot?

The answer, at least in this case, is no professor at all. I took my introductory economics class through StraighterLine, an online provider of higher education that has made numerous headlines over the past couple of years for its unusual business model. Students can take StraighterLine courses for an exceptionally low price, then receive college credit through one of StraighterLine's partner colleges, or through another institution that awards credit for courses evaluated by the American Council on Education's Credit Recommendation Service (ACE CREDIT recommends college credit for 15 of StraighterLine's courses, including the lab and non-lab versions of two science classes) -- StraighterLine itself is not accredited.

StraighterLine courses are not led by instructors; instead, students work through the materials at their own pace, with the (optional) aid of up to 10 hours of tutoring per course, provided by the online tutoring company SmarThinking -- another business started by StraighterLine's founder and current CEO, Burck Smith. StraighterLine does not offer degrees or certificates, simply courses a la carte: at present, it offers about 17 different classes in a range of general education subjects, mostly at the remedial or introductory level. (According to its website, StraighterLine is "developing 11 new courses that will launch in the first half of 2011.")

StraighterLine offers three different pricing models, but each results in a total cost far lower than that of college courses offered anywhere else, with the exception of perhaps a handful of community colleges. Students can choose to take any number of StraighterLine classes for a flat rate of $99 per month, plus an additional one-time fee of $39 per course; take a single class for a single payment of $399; or take ten courses over one year for $999. As a result, the company has received a raft of press attention, much of it positive, with a focus on StraighterLine's low cost and the convenience it affords students.

"Affordable, accessible, flexible, high-quality courses with on-demand assistance," wrote Carol Twigg, president and CEO of the National Center for Academic Transformation (NCAT), in a 2009 NCAT newsletter piece supportive of StraighterLine. "What's not to like?"

"There is no question that there is a need to reduce the cost of higher education … and it is clear that StraighterLine is doing this," Twigg's piece continues. "There is a clear benefit to both students and the taxpayer."

And Twigg isn't the only big name in higher ed to shine a favorable spotlight on the company. "Smith may be the person who revolutionizes the university, or he may not be," wrote Kevin Carey, policy director of Education Sector, in a 2009 *Washington Monthly* article about StraighterLine. "But someone with the means and vision to fundamentally reorder the way students experience and pay for higher education is bound to emerge."

But the low cost touted by its advocates has helped fuel suspicion about StraighterLine: what kind of education can it possibly be offering for $99 a month? Students at Fort Hays State University, in Kansas, protested when news of its partnership with StraighterLine broke in early 2009; they worried that it would "cheapen the value of a degree from FHSU," and an English department committee there expressed doubt about the quality and rigor of StraighterLine's composition courses.

In light of this ongoing back-and-forth, *Inside Higher Ed* decided to find out what a StraighterLine course was really like -- firsthand. Last spring, I enrolled in ECON101: Macroeconomics, a course -- indeed, an entire subject area -- I'd never tried during my own college career; the idea was that the unfamiliar material would help keep me from comparing the course to those I took in college.

Smith is "particularly touchy," he acknowledged in an e-mail, about "the frequent criticism … that [StraighterLine courses] don't adhere to the idealized version of a college course.… In my opinion, the more appropriate comparison is how much they resemble a typical college's online course, or an online course for which that college will award transfer credit."

"We're doing nothing in our courses that's different from anybody else," he added in a telephone interview. "So whether it's McGraw-Hill courses, Smarthinking tutoring, Blackboard LMS, course redesigns, or development theory around the courses, there's nothing that's different."

Economics I: Macroeconomics

Putting Together a Course

StraighterLine relies heavily on the good name of McGraw-Hill, as it must: StraighterLine's courses (with the lone exception of general calculus), as Smith noted, are all built with McGraw-Hill course materials, and accompanied by McGraw-Hill textbooks. The main text for the introductory macroeconomics course is *Macroeconomics: Principles, Problems, and Policies*, by Campbell R. McConnell and Stanley L. Brue. This is the 17th edition, released in 2006; an 18th edition was released in 2008 (and is now offered with an "Economy 2009 update"), but, said Smith, "to keep costs low for students, we don't want to use the most current textbook because then there's no vibrant used book market for those textbooks."

According to Smith, StraighterLine does play a role in course design: "We employ consultants and faculty to put the course together -- write the scope and sequence of the syllabus, align with the content, make sure the test banks work, etc." But, for the materials themselves, McGraw-Hill is responsible — a point often cited by StraighterLine's supporters. (McGraw-Hill representatives, contacted by phone and e-mail, did not make anyone available to discuss this story.)

"The same materials we're using are used extensively by schools around the country as well," Smith said. This fact is underscored by Carey's *Washington Monthly* article, which describes a StraighterLine student who noticed that her daughter, a community college student, "was using exactly the same learning modules that she was using at StraighterLine, both developed by textbook giant McGraw-Hill. The only difference was that her daughter was paying a lot more for them…."

Similarly, Twigg's NCAT piece states that "McGraw-Hill educational materials [are] developed by educators who have spent years thinking about how to teach introductory courses to college students… [and] are used by thousands of colleges and universities." In an interview, Twigg affirmed that "the McGraw-Hill courses are, I think, generally regarded as being of high quality."

Course Overview

The course is structured as follows. For each of the 19 chapters in the textbook, there is a corresponding "topic page" in the Blackboard account for the course, showing the assignments for that chapter. Ten of these topic pages assign a new "lesson presentation" for the chapter; each lesson presentation operates essentially like a series of PowerPoint slides with accompanying voiceovers. Five additional chapters (3, 5, 10, 13, and 14) have no new lesson presentation, but instruct the student to rewatch the previous chapter's presentation while focusing on a different set of issues. Four chapters (15, 17, 18, and 19) make no mention of a lesson presentation at all.

Each topic page directs the student to read the corresponding chapter in the textbook, as well as that in the study guide. Many — though by no means all — of the topic pages also have a set of online review activities; these generally include a set of flash cards, a crossword puzzle, a jumble, a matching game, and a round of "beat the clock."

Each chapter also includes two practice tests (not timed or graded), consisting of 10 multiple-choice questions each, and one graded exam of 40 multiple-choice questions, with a two-hour timer (this time limit is a relatively recent change; until earlier this year, students were allowed five hours to take each test). When I took the course, it did not have a cumulative midterm or final exam, although the latest version (which is otherwise unchanged) has both.

To get assistance with any of the subject matter, students can schedule a half-hour online tutoring session with a SmarThinking tutor; the appointment must be made at least 48 hours in advance, and the available hours are extremely limited (at the time I was taking the class, there were a total of four half-hour tutoring slots for macroeconomics each week; as of this writing there appear to be six). Students can also simply "drop in" during SmarThinking's live tutoring hours, which vary by class and time of year -- but in most cases, and particularly in economics, are not "24/7," as articles about StraighterLine often state.

Lesson Presentations and Review Materials

The value of the lesson presentations is debatable. The material that appears on each test is in the corresponding textbook chapter; the information in the lesson presentations often bears only a vague relationship to the content of the textbook, let alone the tests.

The website for McGraw Hill Online Learning explains that the "courses were built using a set of topics that follow a critical path of knowledge — not a specific textbook's table of contents…. [The courses] are intended to augment and enhance a textbook; the course content is original and does not 'parrot' any book."

In other words, the material in the lesson presentations isn't tied to the material in the textbook. In theory, having the topics covered in a different way, with different examples and explanations, should help students understand and retain the material; in practice, the lesson presentations are often condescending and sometimes utterly befuddling. Students who just want to get through the course and get the credit — that is, the students who are most likely to turn to StraighterLine — have no reason not to skip the presentations entirely: the final grade is simply a tally of all exam scores, and the exams are clearly based on the textbook, so in this sense the lesson presentations are extraneous.

Exacerbating the apparent irrelevance of the lesson materials is their sloppiness in both structure and content. Grammatical and typographical errors like "ressecion," "Ben Bernake," and "camp councilor," among many others, occur with distracting frequency. Text boxes often appear where they shouldn't, or don't say what they should; hovering over the highlighted keyword "depression" on one slide brings up a text box reading only "insert definition." A table showing supply curve determinants is entitled "Approximate Absolute Thresholds for Various Senses." A slide about the Phillips Curve notes that "According to this model, if unemployment and inflation have a stable, inverse relationship. Growth in the economy brings with it inflation."

And, of course, the material is dated; the example that begins this article is one of many. The very first lesson presentation — the course introduction — uses the example of the Great Depression to illustrate the importance of macroeconomics. The text and narration are filled with remarks like these: "There are factors within our economy right now that might send us into the next depression: a housing bubble, a sudden drop in agricultural supply due to the environment, even another stock market crash. The good news is that sound fiscal and monetary policy is in place to buffer the effects of these possible outcomes in the marketplace."

The content is also filled with minor bugs, particularly in areas that are meant to be interactive: hovering over a keyword to see its definition often causes the entire screen to wiggle back and forth, while clicking the answers to "Self Check" questions sometimes brings up an incorrect response, or a blurb of text that clearly belongs to another topic entirely.

(*See the slideshow of course errors and bugs below; to increase text size, click "Menu" and then "View Fullscreen." To return to original view, press your keyboard's Escape key.)*

The review activities are of similar quality. While there are a total of five different types of activity, they are all designed to do the same thing: help the student memorize key terms and definitions. While this is itself a worthwhile goal (though of dubious value for taking an open-book test with ample time to look up word definitions — but more on that later), it is of no use for the areas in which students are most likely to want assistance, such as how to read and interpret graphs, or calculate figures such as GDP. And even for the purpose they do serve, the activities are lazily done: some "crossword puzzles" consist of just a single word across and one down, while one "jumble" invites the student to unscramble the letters "GPD" -- while offering the (incorrect) definition, "The difference between actual and potential output in an economy; this can be positive or negative."

Advising and Tutoring

There are two basic ways that students can seek outside assistance. For administrative or customer service questions, they can contact their course adviser; for questions related to the actual course material, they have the allotted 10 hours of SmarThinking tutoring (minus five minutes per session for "processing").

I found that my course adviser -- who (along with Burck Smith and StraighterLine generally) had no knowledge of this article until after I finished the class -- was available and willing to assist me; I e-mailed him at least a half dozen times as I went through the course, and in each case he wrote back within a day, and often sooner (his replies tended to be very brief but -- more often than not -- helpful).

The tutoring arrangement is less convenient. For those unfamiliar with the service, SmarThinking tutoring takes place in a sort of chat session; the interface is a large white browser window into which students can type questions and their tutors can type responses. My questions showed up in large red letters, while my tutor's replies were in large blue ones. This was helpful for distinguishing between my words and those of my tutor, although the format of the chat session is such that our words often overlapped and became illegible. When one "page" of type is filled up, the chat session opens a new, blank page, and my tutor and I frustrated one another — and wasted time — by inadvertently moving back and forth between pages.

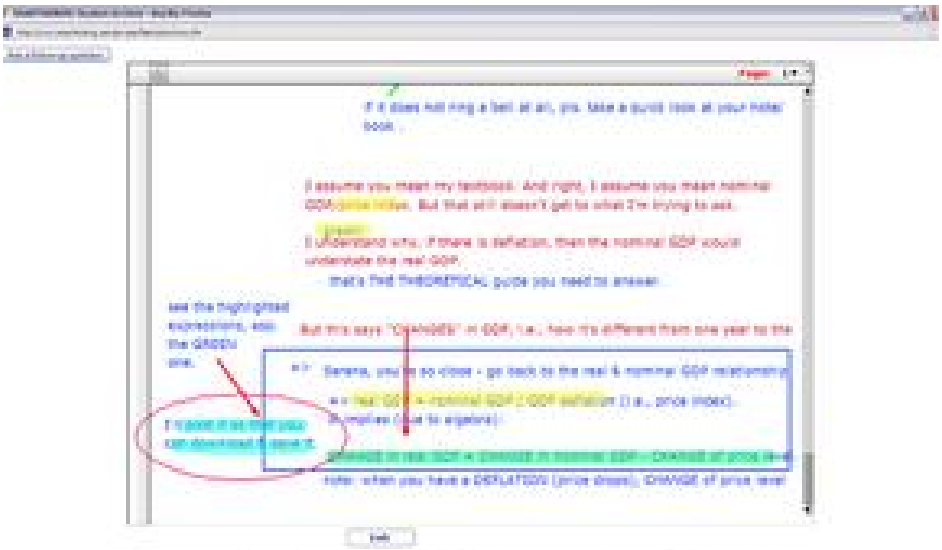
Tutors have no access to the course materials or any of the work that students have done, so each question must be explained in the absence of any context — and unlike at a university tutoring center, where this might also be the case, online students cannot simply bring in a few pages of their work by way of example. To ask about a particular graph or illustration, the student must either save the image to his computer and upload it into the chatbox (which, in my experience, sometimes resulted in graphs too small to read), or save it in an online image program and send the tutor a link — all of which requires time and patience.

While the chat interface made the experience more difficult than it might have been, the first tutor with whom I interacted — who introduced himself as Dr. Randy R. — seemed to have a strong understanding of the subjects I asked him to explain, and his responses were patient and clear.

My second tutoring experience was worse. This time, I logged in to a live tutoring session rather than scheduling one in advance; my tutor, Ling C., stressed that I could ask only a single question "to ensure that we can help as many students as possible." Throughout the session, which lasted only a few minutes, he gave brief answers that didn't clear up my confusion; when I said I was still not following, he used highlighting and arrows to point to the answers he'd already given, then logged out before I had a chance to request further clarification.

Exams and Practice Tests

My grade for the course was calculated from my scores on the 19 chapter exams — each with 40 questions worth one point each, for a total of 760 possible points. Students in the latest version of the course would also have to take the 60-question, 120-point midterm and final exams, for a total of 1000 possible points. (According to the StraighterLine FAQ, a "70% or higher average [is] required to be recommended for credit by ACE and most partner colleges"; most partner colleges will record a course grade only as pass/fail, but some give letter grades corresponding to a student's percentage score.)



An unsuccessful tutoring session. Circled is the last thing my tutor said before abruptly logging out.

Taking a course with no cumulative exams was a peculiar experience, as I was free to forget the material from each chapter as soon as I moved on to the next. StraighterLine seems to have remedied this problem; Smith says that to the best of his knowledge, all StraighterLine courses now have cumulative final exams. In his words, I had “fallen through the cracks in a course switch." The midterm and final, he said, were added in April (I started the class in March), as the result of "friendly suggestions" made by the American Council on Education and Fort Hays State University (it was also these suggestions that led to reduction of the test time limit from five hours to two).

Like the other course materials, the practice tests and exams are scattered with typographical errors; more worryingly, they also contain a number of wrong answers (as seen in the slides below). StraighterLine's FAQ contains instructions for students who suspect that their test contains an error:

"After you have completed the exam, you can view the questions, your answer and whether it was correct or incorrect. Your course advisor can help you to get a copy of the entire question (including incorrect answer options) so that you can take the question to a SMARTHINKING tutor to determine if there was an error with the question. If the tutor finds an error with the question, email your Course Advisor the discussion with the tutor. If there is indeed an error, you will not be penalized for missing that question."

(*See the slideshow of test errors below; to increase text size, click “Menu” and then “View Fullscreen.” To return to original view, press your keyboard’s Escape key.)*

This is exactly what my course adviser told me to do on the multiple occasions when I asked him about errors on my test (though at no point did he provide me with a copy of the entire question, which would have been useful); in one case, however, I included screenshots showing that my answer had obviously been marked in error, and he added two points (rather than just the one I'd lost) to my test score.

"Every time we get something like that," Smith said, "we note it. If we can change it we do; if it's something that we can't change… then we send it off to McGraw-Hill and they can put that in future updates."

It's hard to say whether most students would go through the process of asking their adviser and then consulting with a tutor about whether the test was in error -- for the student in a hurry, that's a lot of effort for a single point in a 1000-point course. (Or no points at all, in the case of the practice tests.) More worrisome is the idea of a student seeing his answer marked wrong on a practice or graded test, failing to realize that the error wasn't his own, and thinking he must somehow have misunderstood the concept being tested.

Not every StraighterLine course is graded solely on multiple-choice exams: "It varies based on the class," Smith said. "So composition courses are written assignments; our business communication [course] is some written assignments and some multiple-choice questions. For some of the future courses that we'll bring out, like psychology, we'll probably have at least one written assignment in there. And I'm not opposed -- and we may add written assignments to econ and accounting."

'The Same No Matter Where You Go’

After taking the course, I spoke with faculty members in economics at a variety of institutions -- some of them StraighterLine partner colleges, others not -- in order to get a better sense of whether the class was really, as Smith put it, "the same experience" that a student would get taking a comparable course (online or otherwise) from a more traditional institution.

Of these faculty members, only Carl Parker, chair and professor of economics, finance and accounting at Fort Hays State University (a StraighterLine partner college), had any firsthand knowledge of StraighterLine's

courses, and specifically the introductory macroeconomics course. Along with several other of Fort Hays's doctoral faculty in economics, he said, he had personally reviewed StraighterLine's economics courses. "We didn't take the class," he said, "[but]…we did take a look at the book, the content, and how they set up their exams, that kind of thing."

"I think it would be similar to the course in principles of economics that a student would take at any university in the country," Parker said, adding that the McConnell and Brue textbook is widely used and well-regarded. "So in terms of the content, we didn't have an issue with that."

Parker noted, however, that "all of the people that teach [Fort Hays's] courses online have their Ph.D.," and that this difference between Fort Hays and StraighterLine could "lead to us not being able to continue our relationship with them." Fort Hays, he said, is seeking AACSB accreditation for its economics classes, "and they require that the faculty teaching courses be either academically or professionally qualified."

"We have no idea," Parker continued, "…about the faculty teaching those courses at StraighterLine" — it wasn't clear whether Parker was aware that StraighterLine courses aren't really led by a faculty member at all — "so… it hurts us with our accreditation."

Exams, Assignments, and Academic Integrity

"[StraighterLine] actually covers more chapters in their course than we do," said Parker. "We cover a few less chapters, maybe emphasize a few of them a little more than they do." This emphasis, in fact, relates to "the one thing with StraighterLine that we kind of disagreed with" — the practice of giving exams that are equally weighted across all subject areas. At Fort Hays, he said, "we give exams that are weighted toward the more important concepts," such as "a thorough understanding of the supply and demand model."

Parker also noted that his own students have only an hour to complete each 40-question multiple-choice exam (of which he gives four: three midterms and one cumulative final), the idea being that students "don't have time to look it all up." Students in Parker's classes also have graded homework assignments in formats besides multiple choice, such as fill-in-the-blank and short answer.

The economics department at Fort Hays is planning a complete overhaul of its introductory macro- and microeconomics courses, Parker said, and "in the revision of the course we're going to do more writing answers," in an effort to incorporate a greater degree of critical thinking into the curriculum.

David Shapiro, professor of economics and co-director of undergraduate studies at Pennsylvania State University (which has no affiliation with StraighterLine), noted that the exams in Penn State's introductory economics courses (online as well as in-person) are never strictly multiple-choice -- about 40 to 50 percent of each test, he said, is composed of multiple-choice questions, and "the balance is short answer, problems to work, graphs, and short essays."

When he is evaluating economics courses for transfer credit, Shapiro said, "when the exam is all multiple choice, I'm like, 'Uh, that's low-quality.' You want students to be able to generate diagrams on their own."

John Volpe, until recently assistant dean and college professor in the department of business and professional programs at the University of Maryland University College (no affiliation with StraighterLine), said that the exams for introductory macroeconomics courses (online and in-person) in his department have a mix of question types: "I'd say maybe 30 percent multiple choice, 20 percent short answer, 50 percent essay." At present, students in both versions of the class must take a proctored final exam. Students in Volpe's classes are also assigned a term paper of at least ten pages, and online students must participate in graded weekly conferences — in which they discuss various topics in economics — as well.

For his part, StraighterLine's Smith argued that it isn't necessary to use a form of assessment beyond multiple-choice tests, which he called "a tried and true method, particularly in high-enrollment courses." Asked if having written assignments might help an instructor determine whether a student was cheating, Smith said, "That is one of the things people say, is 'I know my students and I know their writing and I know if things change.' And that just doesn't hold up. I mean, if a student is going to have someone else take their course for them, there's no way of knowing if that writing has changed."

"I'm not a big fan of unproctored [multiple-choice] exams as an assessment," said Twigg, of NCAT. "That's the weaker side… I'm not crazy about [multiple-choice] exams in general." But, she said, to organize an entire course around such tests is "within the universe of acceptable practice, it seems to me."

Instruction, Assistance, and Interpersonal Interaction

"The idea of online learning is not only learning from me but also learning from their peers," said Volpe, explaining why his online students must participate in conferences. And Smith did agree that some students might prefer "more of a discussion environment" than StraighterLine provides.

"At some point," he said, "we will add a more social element into the course… the only barrier is really scale. If students move at their own pace, to do a course with social elements, students have to be in the same place at the same time."

Even more central to StraighterLine's model than its present lone-wolf structure is the idea that students can do just as well in a course not led by an instructor. This notion is also less widely accepted — many institutions offer online courses that are to some degree self-paced or "rolling enrollment," thereby limiting or eliminating interactions among students, but these courses are typically still led by a faculty member.

"I think it depends a lot on the students," said Carey, of Education Sector, in an interview. "Some students benefit a lot from being led by an instructor, and some students don't need it."

Penn State's Shapiro noted that when he was teaching an online introductory microeconomics course, "some students were able to do the course with very little questions for me or feedback from me."

Of course, such students exist in face-to-face courses, too; Paul Watro, professor of economics at the downtown campus of Jefferson Community and Technical College (a StraighterLine partner college), observed that while he holds office hours for students who might need assistance, "I don't get too many people who come to my office for help, and I think that's probably because they don't have the time. A large percentage of students are working, and they're working a lot."

Watro, whose classes are capped at 30 students, is available for those who do seek assistance — but, as Smith pointed out, professors whose classes are much larger may interact with their students far less. He cited a recent story in *The New York Times* describing the large — and largely online — courses offered to on-campus students at the University of Florida: "The… 1650-student online statistics course, I mean, to what extent is that instructor-led?"

"There are certainly some online courses where the faculty member is involved and very proactive," said NCAT's Twigg, "but I think the majority of online courses follow the StraighterLine model.... That's really the way a lot of online courses are offered."

John Bourne, executive director of the Sloan Consortium, offered a contrasting view of online teaching. "Our mantra is that courses should be instructor-led, and adapt the materials for what people need, and work with

people. …The interaction between people, an instructor interacting with the group, is fundamental to online education."

Without that dynamic, Bourne said, "it's simply… like correspondence courses. …It would be incorrect to include under the rubric of 'online' these correspondence courses that StraighterLine is offering, because they're not online courses as portrayed by Penn State or UMUC or any of the schools that are offering real online courses."

"Consider the University of Phoenix," Bourne added. "Phoenix keeps the classes really small, they train the faculty really well… . They really prepare the faculty to make sure the students are getting the information and understanding it."

One of the important functions of a faculty member in economics, those interviewed for this article generally agreed, is to help students relate the information they're learning to the events taking place in the world they live in. "When you want to interest a person in economics, you want to talk about current happenings," Parker said.

Volpe offered an even stronger view of an economics instructor's responsibility to relate course material to current events. When told that StraighterLine's course materials in macroeconomics had not been updated since before the global economic crisis of the past several years, and thus made no mention thereof, he replied, "If we were doing that here, I should be fired. That would be pathetic. That would be a disservice to the students."

Smith didn't dispute the idea that it matters for students whether the material in their economics courses is tied in with current events — at least, "to a certain extent."

"It does make sense to update the courses," Smith said. "And we do so periodically." He noted, however, that "the various reviews and… validation processes we've been through have occurred since the writing of the courseware"; for example, StraighterLine's courses "were reviewed by the American Council on Education in November 2009." The introductory macroeconomics course, he added, had just been approved for AP credit. None of these outside reviewers objected to the somewhat dated course material, Smith said.

Carey took a similar tack, if perhaps a more direct one. "I think what it illustrates, in a way, is that StraighterLine's value proposition is not that they offer the world's best economics classes," he said; "it's that they offer good-enough economics classes at the world's cheapest prices. And that's fine. I mean, it should be fine."

'It Should Be Fine'

Perhaps all of the back-and-forth about StraighterLine — the news stories, the blog posts, the assorted incidents of backlash, the endless tug-of-war over who awards credit for what — might be boiled down to two essential questions: Are StraighterLine's courses truly more or less equivalent to the courses that many college students are already taking? And, more broadly, at what point does any educational experience — specifically, in StraighterLine's case, an introductory-level general education class — become worthy of college credit?

The former question addresses the level on which Burck Smith would like for his brainchild to be evaluated; the latter is an issue that he actively seeks to avoid. In a long series of emails over the course of several weeks, as well as one 90-minute telephone interview, Smith repeatedly and expressly urged me to "make sure to compare our courses to other colleges' general education courses with whatever evaluation standards they use rather than what they say they do or wish they did."

"…[E]veryone else is doing the same thing," Smith said, "but they're allowed to be accredited and approved and sort of part of the club."

If one accepts Smith's terms of debate, it is difficult to argue with him. Surely accredited institutions offer plenty of courses that are not of the utmost quality. And colleges and universities do turn a profit on many large, introductory-level courses — particularly courses that are taught by low-paid temporary instructors, or broadcast online to vast numbers of students — and that profit is used, as Carey's *Washington Monthly* article puts it, "to pay for libraries, basketball teams, classical Chinese poetry experts, and everything else."

How colleges pay their classical Chinese poetry experts is not Smith's concern; on the contrary, he views himself as something of a consumers' advocate. "When you can start breaking apart these elements of the college," he said, "now you can create different overall instructional models that may work better for students."

Carey's article takes the point a step further: "If enough students defect to companies like StraighterLine, the higher education industry faces the unbundling of the business model on which the current system is built. The consequences will be profound."

"Let's say," Smith said, "…[that] I don't want the fabulous, immersive— that I'm not ready to pay for the fabulous, immersive liberal arts environment. So what works for me instead? Getting the basic English comp course might. You put that in the article… and people are going to say, 'Oh, [StraighterLine], it's a low-quality course,' but that's not the issue. The issue is that we are a sufficient and even a better course, in many cases, at a far better price. So we are far better value than what most colleges are doing — and it's this concept of value that I think is entirely missing from course-level discussions."

Photo: Courtesy Baltimore Sun

Burck Smith, StraighterLine's founder

"The issue," that is, meaning the issue as defined by Burck Smith. But the two questions need not be mutually exclusive; the one might even inevitably raise the other: Does StraighterLine indeed offer courses as good as those provided by many accredited institutions? And if defenses of StraighterLine often seem to boil down to

the argument that, well, it's not that great, but it's good enough (and much cheaper), does that not raise — or perhaps beg — the question of what it means to *be* good enough?

'Nothing… That's Different From Anybody Else'

I can't answer the question of whether I learned more or less from my StraighterLine course than I might have learned elsewhere. Watro, Parker, Volpe and Shapiro all seem to be offering their students an experience that is more in-depth, more challenging, and more relevant than the course that I took — but of course, as Smith noted, "Professors have internal incentives to say, 'The course I do is better than this' … because that's their livelihood."

Asked whether UMUC, Penn State World Campus, Jefferson Community and Technical College, or Fort Hays were fair bases for comparison, Smith said, "I don't want to say they wouldn't be good examples; I think the best comparison would be to take… a large online economics course through someone else's program in sort of a similar format at similar price points."

Of course, part of the problem with that strategy (besides the issue of having world enough and time) is that there may not be many (or any?) classes in a similar format — and, particularly, at similar price points.

"And that's part of the point," Smith said. "We're providing the best value."

Of all the professors I spoke to, it was Watro — who does not teach any online classes — whose courses sounded perhaps the most similar to the one I took from StraighterLine. His exams and homework, he said, are largely multiple choice, though he said he also assigns "take-home questions, which are more short-answer — problems and short explanations for things." Do Watro's students — who don't have the option of tutoring for their economics courses, "because [JCTC] can't get anyone to tutor students, given what they pay, and given very few people can do the tutoring in economics as opposed to other courses" — learn more than StraighterLine students taking the same classes?

Watro, for his part, opposes online education on principle. "Economics is a very challenging class, and I don't think online is really teaching, to be quite honest with you. … And then there's lots of issues in terms of interactions with the students and… who's actually taking the exam when the exam is being given."

Watro said that he was unaware of his institution's relationship with StraighterLine — which, he said, he'd never even heard of.

'A Sufficient and Even a Better Course'

My final grade in my economics course was 739/760 — a shade over 97 percent. I didn't cheat, but then, I never was quite able to figure out just what it would mean to cheat in a StraighterLine course. The student handbook says, "SMARTHINKING tutoring should not be used while completing graded exams," but does not mention the use of notes, the textbook, the study guide, Google, friends or other experts, or anything else. I even tried to get my course adviser to clarify:

Dear Andrew:

…I realized when I was taking a test the other day that I couldn't recall what StraighterLine's policy is for using the textbook/study guide/notes/websites etc. during an exam. I know we're not supposed to get tutoring during a test (obviously!), but I actually have no idea if I'm allowed to use books or not. …

… Can you point me toward StraighterLine's policy on what is and isn't allowed during tests?

Let me know, and thanks!

Serena

Serena,

I apologize for the delay in getting back to you. It is fine to use your books on the exams, but as you noted not the Smarthinking tutors. Let me know if you have any questions. Thanks.

Andrew

For the first few tests, I didn't use the textbook, though I still did just fine; after receiving this e-mail, I simply double-checked all my answers in the textbook before answering each test question. Knowing I could do this, I cut my studying to the minimum. I would go through each lesson presentation (though only for the sake of this article, and only ever once each — why re-read them for later chapters when none of it would be on the test anyway?) and then read the chapter in the textbook. I didn't bother with the study guide, which simply gave a condensed version of the material in the textbook, or the review activities, given their marginal relevance and quality.

This minimal effort was more than enough for me to do as well on the exams as I did; I started to wonder whether I could do as well without reading the textbook at all (since I was consulting it during the exam anyway), but couldn't bring myself to test that theory.

Of the fact that I was able to earn a 97 percent with such a modicum of effort, Twigg observed, "But that's true in any college course. … You could find face-to-face courses on any campus in the country and that would be the case." She recalled her undergraduate years at William and Mary, where, she said, she took two years of French without attending the class. "I just took the tests, and got Bs."

"I think the level of engagement, to me, is not the critical factor. The critical factor is how well students do on the assessments," said Twigg.

Similarly, when I told Burck Smith I'd gotten a 97 percent in the class, he replied, "Congratulations! It worked!"

Of course, Smith has never pretended that StraighterLine offers the ideal educational experience: "We're not in the business of making the best courses. We are in the business of making the best value courses." He himself attended Williams College as an undergraduate. In an ideal world, would every student get an education like that — face-to-face, in small classes at a top-quality liberal arts college?

"Sure, sure," Smith said, laughing. "It's terrific. Who wouldn't want it?"

"We are living in a world," he added, "especially now, where there are harsh budget realities. You can't -- and so tradeoffs are going to have to be made. So where are those tradeoffs, and who makes them? Is it the taxpayer? Is it the student? … I mean those are all up in the air, and if we continue to try and hold people like StraighterLine and others to standards that colleges aren't really upholding themselves, but wish they were, then we're really not going to get anywhere."

For all of Smith's staunch, articulate defenses of his model, it was Twigg whose summation stuck with me.

"Within the universe of institutions," Twigg said, "there are high-quality courses and mediocre courses and really lousy courses…. [StraighterLine] is well within the sort of mediocre and above, because of the oversight that's gone into it."

"I think it's certainly a viable option within the panoply of higher education offerings," she concluded. "How's that for a lukewarm endorsement?"

She paused, laughing.

"It's as good as the other stuff."

— Serena Golden

http://www.insidehighered.com/news/2010/12/16/review_of_straighterline_online_courses

The Bad Daddy Factor

Drinking, smoking, taking prescription meds or failing to eat a balanced diet can influence the health of men's future children.

By Emily Anthes

(Illustration by Mark Fredrickson)

The fathers weren't supposed to matter. But in the mid-1960s, pharmacologist Gladys Friedler was making all sorts of strange findings. She discovered that when she gave morphine to female rats, it altered the development of their future offspring — rat pups that hadn't even been conceived yet. What's more, even these rats' grandchildren seemed to have problems. In an effort to understand the unexpected result, she made a fateful decision: She would see what happened when she put male rodents on the opiate. So she shot up the rat daddies with morphine, waited a few days, and then mated them with healthy, drug-free females. Their pups, to Friedler's utter shock, were profoundly abnormal. They were underweight and chronic late bloomers, missing all their developmental landmarks. "It made no sense," she recalls today. "I didn't understand it."

For the next several decades, Friedler tried to understand this finding, ultimately assembling a strong case that morphine, alcohol and other substances could prompt male rodents to father defective offspring. There was only one problem: No one believed her. Colleagues questioned her results — her former adviser urged her to abandon the research — and she struggled to find funding and get her results published. "It didn't occur to me that you're not supposed to look at fathers' roles in birth defects," Friedler says. "I initially was not aware of the resistance. I was one of the people who was actually naïve enough to work in this field."

Over the last half-century, as scientists learned more and more about how women could safeguard their developing fetuses — skip the vodka, take your folate — few researchers even considered the possibility that men played a role in prenatal health. It would turn out to be a scientific oversight of significant proportions. A critical mass of research now demonstrates that environmental exposures — from paints to pesticides — can cause men to father children with all sorts of abnormalities. Drinking booze, smoking cigarettes, taking prescription medications and even just not eating a balanced diet can influence the health of men's future kids. In the several decades since Friedler started her work, the idea that chemicals in a man's environment can influence the health of his future children has, she says, "moved from lunatic fringe to cutting edge."

So why don't we ever hear about it?

As an andrologist, Bernard Robaire has spent his career studying the functions and dysfunctions of the male reproductive system. In the early 1980s, he was giving grand rounds at the McGill University Health Center in Montreal when an oncologist approached him with a question. The oncologist had been treating men with testicular cancer; chemotherapy and radiation were generally expected to render the patients infertile. But lo and behold, tests were showing that, even after the cancer had been licked, some of the men still had viable sperm. The patients had concerns, however: Were the sperm defective? Was it safe for them to have kids? The oncologist, surprised that reproduction was even an option for his patients, had no idea. He put the question to Robaire.

Robaire was equally stumped. He combed through the scientific literature but couldn't find a clear answer. So he decided to research the question himself. He paired up with a specialist on birth defects, and together they put together an application for a grant to study whether cancer drugs might damage sperm in ways that put men's future children at risk. They submitted their application to the Medical Research Council, Canada's equivalent of the National Institutes of Health. "And I had the absolute worst ranking on a grant I've ever had in my life," Robaire recalls today. The scientists reviewing the application rejected it outright. "This makes no sense," they had written. "How can you expect drugs given to the male to affect the progeny?"

It wasn't an unreasonable question. There was no obvious physiological mechanism that could explain the connection. It's the woman who makes her body home to a developing fetus, and damaged sperm were widely thought to be too weak to successfully fertilize an egg. The conventional wisdom, among oncologists, was that anti-cancer drugs would kill sperm, but after stopping treatment, sperm production would begin again — and the germ cells would be normal.

But that's not what Robaire found. In his early rodent studies, he discovered that chemotherapy agents could degrade the quality of sperm. These sperm were still capable of fertilizing eggs, but the embryos would often spontaneously abort themselves. Among those that actually survived to term, the rodent pups had abnormally slow development. Since then, Robaire has continued to study the effects of chemotherapy drugs on sperm in rodents and humans; some of his most recent work reveals that some men continue to manufacture damaged sperm — with abnormal numbers of chromosomes and breaks in DNA — for as long as two years after their last dose of chemo. "The chemo causes really dramatic damage," Robaire says.

While Robaire was slogging away, other scientists were quietly accumulating similar evidence. Some of the early work showed that women had more miscarriages when their male partners worked in manufacturing jobs where they were exposed to heavy metals, such as lead and mercury. Men exposed to pesticides were more likely to have children who developed leukemia. (For years, studies have linked Agent Orange, an herbicide used during the Vietnam War, to birth defects in the offspring of veterans, but a causal link has not been definitively established.) Other research suggested that men who worked with solvents, cleaning solutions, dyes and textiles, paints and other chemicals were all more likely to father kids with birth defects or childhood cancers.

Scientists also showed that it didn't require industrial-strength chemicals to wreak havoc on men's sperm. Smokers seemed to produce sperm with the wrong number of chromosomes, a DNA error that could lead to miscarriages or Down syndrome. (A stunning 2008 paper revealed that men with deficiencies in folate, that superstar maternal vitamin, had the same problem.) Paternal smoking has also been linked to childhood cancer, and even alcohol and caffeine can cause sperm abnormalities that derail child development.

We now know that what started as an inconceivable mystery — how could men's environments and lifestyles possibly affect the children they would later father? — has not just one but several answers. Certain substances interfere with the earliest phase of sperm production in the testes, prompting errors in cell division that lead to genetic mutations in immature sperm cells. Chemicals can also cause what are known as epigenetic mutations, which don't change the DNA sequence itself but alter how the body reads these genetic instructions. Essentially, an epigenetic change involves turning certain genes on or off, telling the body to pay more or less attention to the code they contain. (If genetic changes are akin to changing the lyrics of a song, epigenetic changes are like fiddling with the volume.)

Drugs can also interfere with sperm transport. A 2009 study revealed that a standard dose of paroxetine — the active drug in the antidepressant marketed as Paxil — causes a fivefold increase in the number of men who show evidence of "sperm fragmentation," which can increase the chances of miscarriage. Researchers have known that certain antidepressants can influence ejaculatory response; it turns out that they seem to slow the transportation of sperm through the male reproductive system, causing the cells to age prematurely. "Sperm are being damaged because they're not traveling properly through the body," says Peter Schlegel, who led the study and is a urologist at New York's Weill Cornell Medical College.

And these findings are just the beginning. Consider, for instance, that there are some 84,000 chemicals used in American workplaces, says Barbara Grajewski, a senior epidemiologist at the National Institute of Occupational Safety and Health. Only 4,000 of these have even been evaluated for reproductive effects in men or women, and males are particularly understudied. "There's a whole range of effects in men that really are not being given attention or are well understood," Grajewski says. "The whole area of men's reproductive health is way behind women's health."

The implications of this research deficit are huge. Some 60 percent of all birth defects today are of unknown origin; tracing even a small fraction of these back to men's environmental exposures would constitute a major public health advance.

Despite the accumulating findings, the idea that fathers can somehow contribute to birth defects has gained little traction in the public sphere. Cigarette packs have no warnings about the association between male smokers and birth defects. A woman who drinks while she's pregnant can be prosecuted, but most men have no idea that drinking in the months before conception is risky.

"Why would we not look at the paternal side of the equation? To me that's really a social and political puzzle," says Cynthia R. Daniels, a political scientist at Rutgers who studies gender and reproductive politics. "We seem to politically be in a place where we overprotect and over-warn women, but where men and fathers remain almost completely invisible. You're not likely anytime soon to see signs in bars that say, 'Men who drink should not reproduce.'"

We still assume that men are secondary partners in reproduction, that their biological contribution to a child is fleeting and ultimately less important than women's, Daniels says. What's more, both men and women can find the research threatening. After Friedler organized a scientific symposium on the paternal-fetal connection, she found herself in the elevator with two male colleagues. They turned to her and said, "Why are you picking on men?" On the other hand, when Friedler later had a fellowship at an institute for female scholars, some of the women there challenged her, demanding to know why she was spending so much time researching men. She couldn't win.

Even when the science is unambiguous, policy seems to lag. For decades, only women were banned from the lead trade, though the evidence suggested the metal could cause stillbirths and fetal problems regardless of which parent had been exposed. Today, federal occupational and health standards protect men from lead, but there are lots of regulations missing for other dangerous compounds.

Consider the well-documented hazard presented by anesthetic gases. The female partners of men who work as dentists, operating room technicians or anesthesiologists are more likely to experience miscarriages. On its website, the Occupational Safety and Health Administration has a lengthy document devoted to the hazards presented by anesthetic gases and how companies can protect their workers. But, in a prominent message at the top of the page, the agency comes straight out and says, "These guidelines are not a new standard or regulation, and they create no new legal obligations. The guidelines are advisory in nature. …"

By law, employers are required to provide what are known as "material safety data sheets" that outline the hazards involved in any chemicals their workers might encounter. A team of researchers discovered that these sheets were 18 times more likely to mention risks to female reproduction than male reproduction. To be fair, it's harder to figure out what to do to protect men. With women, it's obvious — keep them away from these chemicals during pregnancy. But what do you do with men who are constantly making sperm and could contribute to a pregnancy at any point?

Well, we should start with a thorough review of the evidence, Daniels says, and then establish a commission to develop appropriate policy. It's also clear more research is needed — particularly research that asks the right questions. The FDA requires that new drugs be tested in rodent models for any potential effects on sperm production. But while these sorts of analyses will reveal whether a drug drastically affects sperm count, they may not show more subtle changes, says Schlegel, who conducted the study on antidepressants. Unless a chemical has "a huge and dramatic effect on sperm numbers, it often can be missed," he says.

An obvious step toward better fetal health would have obstetricians and gynecologists consider fathers' chemical exposures when trying to ensure healthy pregnancies and children. Ideally, men would be engaged even earlier, with the government issuing guidelines for young men that deal with environmental toxins and lifestyle choices that might jeopardize the health of future children. The time may be right for more engagement; many occupational health and safety guidelines, for men and women, were loosened by the Bush administration. "I think there's a great opportunity now to rebuild standards to include risks to male reproductive health," Daniels says.

There's a generational opening, too, she says. In recent years, she's noticed a change in the reaction male college students have to learning about the risks they face. "I've found, especially among young men, a sense of outrage and alarm," Daniels reports. "They say, 'How could this be? How could it be that no one has ever suggested to me that alcohol might have an impact on my ability to have healthy children?' They're angry that they don't know about this."

http://www.miller-mccune.com/health/the-bad-daddy-factor-25764/?utm_source=Newsletter139&utm_medium=email&utm_content=1214&utm_campaign=newsletters

The Ultra-Imperial Presidency

Yale's Bruce Ackerman, a constitutional scholar, warns that unilateralism in the "most dangerous branch" of government is setting the stage for a tragic future.

By Melinda Burns

Bruce Ackerman discusses how far the country has strayed from the system the Founding Fathers envisioned and how it can get back on track. (MVI/Flickr.com)

Back in 2006, Bruce Ackerman co-authored the "Liberal Manifesto," a document of protest signed by dozens of prominent intellectuals who condemned the "illegal, unwise and destructive" Iraq war and the "politics of panic" of the administration of President George W. Bush. But Ackerman, a professor of law and political science at Yale and the author of the new book *The Decline and Fall of the American Republic*, is worried about more than one unenlightened man in power. He believes that a runaway U.S. presidency could someday be the springboard for an authoritarian takeover. He wants to shake Americans out of their complacent belief that the Constitution will always protect their tradition of government. In the following interview, Ackerman talks about how far the country has strayed from the system the Founding Fathers envisioned and how it can get back on track.

Miller-McCune: Professor Ackerman, you've said publicly that an extremist such as Sarah Palin or her mirror image on the left could be elected to the White House in this century. How would such a candidate arise?

Bruce Ackerman: Since 1972, presidential candidates are selected by activists who vote in primaries, not by party leaders in conventions. These primaries are very poorly attended. And who turns out? It's the ideologues of the left and the right. If a candidate mobilizes the strong ideological base, he or she can win. That means we can have an election in which a relatively extreme lefty runs against a relatively extreme righty.

M-M: But in the past, America has survived what you have called "serious outbreaks of presidential lawlessness" during Watergate, the Iran-Contra affair and the war on terror.

Bruce Ackerman

BA: But we haven't had an extremist in the White House. George W. Bush campaigned as a centrist. He was a compassionate conservative. Jimmy Carter, Bill Clinton, Barack Obama — they were centrists. We've been lucky. But once the president, extremist or not, gets into the White House, he commands a centralized apparatus of control that is far more formidable than Nixon had at the time of Watergate or Ronald Reagan had at the time of Iran-Contra. So that's the second big problem — the centralization of operational power in the White House.

M-M: These are the "superloyalists" your book refers to? You say they should be confirmed by the U.S. Senate.

BA: That's absolutely correct. Before 1939, the president of the U.S. had no [permanent staff advisers]. By no, I mean none. We now have 500 superloyalists in the White House who have a lot of power. Moreover, over time, the White House staffers have increased their power to order government departments around. Since Clinton, it's been very standard for presidents to issue something called directives, ordering the departments to issue one kind of regulation or another. If we had an extremist in the White House, he or she would pick 500 loyalists, almost none of whom are confirmed by the Senate, and then they could start giving orders to the far-flung federal establishment.

M-M: Do some "superloyalists" have more power than Cabinet members?

BA: There's no mistaking the direction of change. Who has more power in matters of foreign policy — the head of the National Security Council or Secretary of State Hillary Clinton? She is a very powerful person. However, she is spending a large percentage of her time, as she should, outside the country. The national security adviser is in the White House every day, talking to the president. It doesn't require a fancy theory to suspect that the people who see the president every day have more effective power. But it's a shifting balance. Personalities matter. The point of this book is to take the 50-year view, not the two-month view or even the

Obama view. But over time, there's no mistaking the general tendency, which is more power in the White House and a diminution of power in the Cabinet secretaries.

M-M: In your view, are Republican and Democratic presidents equally responsible for power grabs?

BA: Yes. It's true that the three worst incidents have occurred under Republican presidents — that is, Watergate, Iran-Contra and the extra-legal, illegal activities of the war on terror. But there has been a bipartisan effort by presidents from Franklin Roosevelt through to the present to aggrandize presidential power. And there are crucial features of the existing edifice that have been built by Democratic presidents. I wrote an op-ed in the *Wall Street Journal* condemning Obama's appointment of Elizabeth Warren, a person whom I happen to admire, to, basically, a decision-making post in the U.S. Treasury Department of the first importance, without gaining the consent of the Senate.

M-M: Right. Warren was appointed to set up the Consumer Financial Protection Bureau. But let's turn to another of your chief worries, the erosion of civilian control over the U.S. military. On what do you base your prediction that the military could someday govern "behind the throne"?

BA: Here, the critical date is 1986, when a statute called the Goldwater-Nichols [Department of Defense Reorganization] Act was passed, which had very fundamental implications for the relationship between the military and civilians. For the first time in American history, the act made one person, the chairman of the Joint Chiefs of Staff, the spokesman for the military. Gen. Colin Powell, who at that time became the chairman, immediately moved to inject himself into public political debate. In 1992, as President George H.W. Bush's chairman of the Joint Chiefs, he wrote an op-ed in *The New York Times* lecturing Clinton about what he should do in Bosnia if he won the election. He formulated the famous Powell Doctrine telling the president when he should use military force. It is not the job of the military to create a fundamental doctrine. Even more remarkably, this was accepted, and further chairmen have built on this in various ways.

M-M: But President Obama last year fired the commander of U.S. Forces in Afghanistan, Gen. Stanley McChrystal. Doesn't that show that the president is in charge?

BA: The McChrystal affair is a symptom of a larger pathology developing, especially since 1986, in civilian military relations. Obama was completely correct in discharging McChrystal for insubordination. McChrystal had absolutely no right in a question-and-answer session in London to say that a withdrawal from Afghanistan would lead to "Chaosistan." When it hit the headlines, Obama had little choice but to assert his authority. But what we have to do is get to the basic structures that are making this increasingly a problem.

M-M: Was it a problem in early 2006 when eight retired generals and admirals called for the resignation of U.S. Defense Secretary Donald Rumsfeld?

BA: They engaged in a very self-conscious effort to discredit Rumsfeld, and they gave *Time* magazine and other people a reason to believe that they were also speaking for the high command. They said Rumsfeld's policies were terrible, we have to get rid of Rumsfeld. And after the 2006 election, President Bush did get rid of Rumsfeld. Was that the appropriate thing for retired generals to do? To lead something that among experts is called "The Revolt of the Generals"? I don't think so. There are no well-worked out guidelines for what retired generals should do. They should be able to speak — they're citizens like everybody else. But what particular restraint should be placed on them? Nobody has thought this issue through. The next time around, we'll have another revolt of the generals which points back to the 2006 experiment.

You could be a critic of Rumsfeld or you could be a defender of Rumsfeld. That's not the point here. Rumsfeld is the civilian head of the defense forces of the United States, and it's a very bad thing for a group

of highly qualified retired generals to campaign for his ouster. That's the kind of problem we have to confront.

M-M: How would your proposal for a "Canon of Military Ethics" help reinforce civilian control?

BA: The idea of the "Canon of Military Ethics" is modeled on the Canon of Judicial Ethics. The judges get together and try to think about practical problems and what the right way to respond to these problems is. When a general is summoned to Congress, to what extent is he supposed to defend the line of the administration, and to what extent should he be free to criticize it? This is a very important problem. A presidential commission on military-civilian relations could have leading generals, former secretaries of defense and various other people hash it out and try to come up with guidelines just as we have for the judiciary, so that people would reflect upon their responsibility.

M-M: In *Decline and Fall of the American Republic*, you say fundamental reforms are needed to rein in what you call "government by emergency," a sweeping expansion of powers that paved the way for the infamous "torture memo" written by John Yoo of the Office of Legal Counsel in the U.S. Justice Department during the George W. Bush administration and the indefinite detention of terrorist suspects at Guantánamo Bay. Wasn't it enough for Obama to repudiate torture and pledge to shut down Guantánamo?

BA: Absolutely not, or fire McChrystal. All these things are desirable, but the pledge to end torture, which I very much support, can be repudiated by the next president of the United States. What you do by executive order, you can repeal by executive order. We have to think about structural steps. … I should emphasize, there's no indication that the Obama administration takes these problems seriously. They have done nothing fundamental and structural to respond to the abuses of the Bush administration, let alone further structural abuses to come.

M-M: Given the potential for abuse, how should the government respond to a terrorist attack?

BA: My proposal is to have a new emergency statute which recognizes that right after a 9/11 catastrophe — and we may well have worse catastrophes in the 21st century — it is appropriate for the United States government and the president of the United States to take really sweeping actions for a brief period of time — I'd say, 45 days. I say, however, that this state of emergency has to be approved by Congress, and that every 60 days thereafter, the president has to go back to Congress and get it approved again, with a supermajority — the first time, 60 percent of Congress has to go along, and the next time 70 percent, and the next time and for every time thereafter, 80 percent. What this means is that emergencies end. Our problem right now, after 9/11, is that so many of the emergency measures, which I would support as short-term devices after a tragic episode, have become part and parcel of our system. And when we have another attack, which we will, people will say, "Well, you know, these measures weren't enough to stop the attack, so let's be even more draconian."

It's never going to end if you just rely on the national security folks. The national security folks are in the business of looking around the world and seeing how many nutcases there are who are threatening us. There are 7 billion people in the world. There are always going to be tens of millions of people who don't like America. And with the big technological shift, it's becoming possible for smaller and smaller numbers of people to buy more and more dangerous weapons for lower and lower prices. Five hundred people with a couple million dollars will, predictably, in 20 years' time, have nuclear capacities. One of these groups is going to be lucky. That's going to happen. The question is, whether it is totally going to destroy our tradition of freedom or whether it will simply disrupt it for a manageable period of time.

M-M: One of the reforms you propose is a tribunal of nine judges for the executive branch that would field challenges from Congress to the president's actions. Wouldn't this conflict with the Supreme Court?

BA: No. The Supreme Court has said that there are large areas of dispute between Congress and the president that it's not going to resolve: It's going to leave it up to the political branches. Fine. I say, let's do that. But how are the political branches supposed to resolve these problems? Right now, we have an increasing number of highly skilled lawyers in the White House Counsel's office and in the Office of Legal Counsel. We didn't have these people before. Before Richard Nixon, there was no trained legal staff in the White House. Now there are 40 lawyers, 25 of them writing very polished opinions. What happens in an emergency is that these lawyers in the White House staff and the Office of Legal Counsel have powerful incentives to write very learned opinions saying the president can do whatever he wants. This is what the John Yoo torture memo represents. I'm not interested in John Yoo as a person; I'm interested in this institutional arrangement which has developed over the last 30 or 40 years which makes John Yoos not only possible but almost inevitable in times of emergency. They will write opinions saying that for one learned reason or other, it's perfectly all right for the president to act in an extreme way, sweeping up thousands or tens of thousands of people on suspicion.

M-M: Specifically, Yoo argued that the Geneva Conventions did not apply to prisoners captured during the war in Afghanistan and detained at Guantánamo. Congress later passed an anti-torture law, but Bush issued a signing statement reserving his right to waive restrictions in it.

BA: Congress passes a statute banning torture: No problem, it's interpreted out of existence by the lawyers in the executive branch. They're issuing opinions that have the force of law. This is a very bad system. Indeed, one of the very small number of things the Constitution says about the president's job is that the president shall take care that the laws be faithfully executed. I say, let the lawyers for the president be lawyers for the president. But we should create a new "supreme executive tribunal" of nine judges with 12-year terms. When Congress says, "We passed a statute that says 'Don't torture,' and we have reason to believe torturing is going on," then there will be an argument before this tribunal. And it will try to make a judicious decision and not wait for a large number of years before the Supreme Court says, "Oh, it's a political question, we're not going to decide this."

M-M: In your book, you say that public opinion polls have become a "privatized voting system" that could be manipulated by an extremist in the White House. How so?

BA: The American democratic system is evolving. Public opinion poll numbers are actually important in assessing the president's legitimacy. This has happened very slowly over the last 20 years or so. It really matters if Obama is at 70 percent in the polls or 20 percent in the polls. Before the 1930s, there were no polls. A person was elected president for four years and he had the legitimacy of his election. Now, when he's at 70 percent in the polls (and Congress is almost invariably 30 or 40 points lower), the president can say, "Look, there's an emergency. We have to take unilateral steps. We can't wait for Congress. The American people support me, and, I tell you Americans, we cannot tolerate 12 million illegal aliens amongst us, we must take action now. Congress is refusing to take action — I am."

The president who is high in the polls can take an illegal action in the name of solving an emergency. This dynamic will become especially exacerbated if we have, as we may well have, a deadlock in Congress. The more Congress is deadlocked and incapable of responding to the nation's problems, the more a president will be tempted to take unilateral action; and if he's high in the polls, his democratic legitimacy will carry him very far. So, this is a fascinating and troubling dynamic.

M-M: You also deplore the unraveling of professional journalism in the Internet age, and you've suggested that a national endowment for journalism be set up with several billion dollars to fund investigative reporting. You don't think bloggers can be good watchdogs?

BA: Sure, they can help, but they're not going to substitute for professional journalism. In order to really follow what's happening in the Defense Department, you have to have people who have connections, who are

reporting on the department day after day, week after week, actually learning things, filtering them and being capable of writing for a general public. What we have in the blogosphere is a group of policy wonks who don't know how to write for the general public putting their things on the Internet, and nobody reads them — and, on the other hand, people with strong opinions who don't know very much.

M-M: In your book, you offer a number of new checks and balances on presidential power, including a national holiday called Deliberation Day, two weeks before a presidential election, to better inform the public about the issues. But you're not optimistic about the country's prospects.

BA: This is why the book is called *The Decline and Fall of the American Republic*. I'm not talking about our relative decline in the world. That's the American empire. We're not declining that fast. We're still a big power and will be a big power for a long time. That's not what I'm worried about. Nor am I worried about the moral decline of the American people. I'm worried about retaining a sense that we Americans are in control of our institutions. And the reason for my pessimism is we can very easily imagine stories in which we have congressional gridlock, obstructionism, do-nothingism — and presidential unilateralism — and another round, and another round. And with these structures of extremism, centralization, politicized military, a very aggressive legal presence of the presidency and the use of media manipulation, without any check, it's easy, unfortunately, to see a rather grim future for the republic.

http://www.miller-mccune.com/politics/the-ultra-imperial-presidency-25965/

Debunking Theories of a Terrorist Power Grab

A Penn State power-system expert cites laws of physics to pull the plug on worries that a terrorist attack on a minor substation could bring down the entire U.S. electric grid.

By Matt Palmquist

Are terrorists going to attack America's electric grid, sending blackouts toppling across the country like dominoes? Nahhhh. (jose1983/istockphoto)

You know all those doom-and-gloomers who get up before Congress and testify about how terrorists are going to attack America's electric grid, sending blackouts toppling across the country like dominoes? Well, here's what Seth Blumsack, a power-system expert at Pennsylvania State University, has to say about the terrifying prospect: "That's a bunch of hooey."

Blumsack and his colleague Paul Hines at the University of Vermont have just published a report in the journal *Chaos* — and we can only imagine what the deadlines *there* are like — that refutes the drumbeat of warnings, many of which have made it to the halls of Congress. Last March, a military analyst testified about a study in the journal *Safety Science* that described how an attack on a minor substation could bring down the whole U.S. grid; a similar paper appeared the next month in *Nature*, presenting a model of how failing interconnected networks led to a cascading blackout over Italy in 2003. But the problem with those models, according to Hines and Blumsack, is that they are only models — mathematical, topographical approaches to understanding complex systems like the power grid, which is notoriously unpredictable.

As Hines puts it in a press release accompanying his study: "Some modelers have gotten so fascinated with these abstract networks that they've ignored the physics of how things actually work — like electricity infrastructure. And this can lead you grossly astray."

In contrast, Hines and Blumsack's study, funded by the National Science Foundation, drew on two fundamental laws of physics — Ohm's and Kirchhoff's laws, for those scoring at home — and real-world

data from the Eastern U.S. power grid in 2005. Their research shows that the most vulnerable points are the ones that have the most energy flowing through them — like huge power stations or highly connected transformers.

“If the government takes these topological models seriously,” Hines says, “and changes their investment strategy to put walls around the substations that have the least amount of flow, it would be a massive waste of resources.”

But when has that ever stopped the government?

http://www.miller-mccune.com/science-environment/debunking-theories-of-a-terrorist-power-grab-25987/

A Psychological Autopsy of Bobby Fischer

Chess player Bobby Fischer's tortured life illustrates why promising young talents deserve better support programs.

By Joseph G. Ponterotto

It's uncertain whether counseling and treatment could have helped American chess champion Bobby Fischer with his chess or his paranoia. But his tortured life illustrates why our most promising young talents deserve better support programs early on. (wikipedia)

At a 1958 tournament in Yugoslavia, Mikhail Tal, a legendary attacking grandmaster and one-time world champion, mocked chess prodigy Bobby Fischer for being "cuckoo." Tal's taunting may have been a deliberate attempt to rattle Fischer, then just 15 but already a major force in the highly competitive world of high-level chess.

But others from that world — including a number of grandmasters who'd spent time with him — thought Fischer not just eccentric, but deeply troubled. At a tournament in Bulgaria four years later, U.S. grandmaster Robert Byrne suggested that Fischer see a psychiatrist, to which Fischer replied that "a psychiatrist ought to pay [me] for the privilege of working on [my] brain." According to journalist Dylan Loeb McClain, Hungarian-born grandmaster Pal Benko commented, "I am not a psychiatrist, but it was obvious he was not normal. … I told him, 'You are paranoid,' and he said that 'paranoids can be right.'"

Robert James Fischer passed away of kidney failure at the age of 64 in January 2008 in his adopted home of Reykjavik, Iceland, where, 36 years earlier, he had captivated the world with his stunning defeat of Boris Spassky, the reigning world chess champion from Russia. As the first North American to win the world title after a half-century of Russian domination, Fischer gained enduring worldwide fame.

By most all accounts a brilliant mind, Fischer was perhaps the most visionary chess player since José Raul Capablanca, a Cuban who held the world title for six years in the 1920s. Fischer's innovative, daring play —

at age 13, he defeated senior master (and former U.S. Open champion) Donald Byrne in what is sometimes called "The Game of the Century" — made him a hero figure to millions in the United States and throughout the world. In 1957, Fischer became the youngest winner of the U.S. chess championship — he was just 14 — before going on to beat Spassky for the world title in 1972.

But Fischer forfeited that title just three years later, refusing to defend his crown under rules proposed by the World Chess Federation, and he played virtually no competitive chess in ensuing decades, retreating, instead, into isolation and seeming paranoia. Because of a series of rankly anti-Semitic public utterances and his praise, on radio, for the Sept. 11, 2001 attack on the World Trade Center, at his death, Fischer was seen by much of the world as spoiled, arrogant and mean-spirited.

In recent years, however, researchers have come to understand that Bobby Fischer was psychologically troubled from early childhood. Careful examination of his life and family shows that he likely suffered with mental illness that may never have been properly diagnosed or treated.

Any psychological evaluation of a person who is not alive must, of course, include a great deal of qualification. But the psychological history of America's greatest chess champion clearly raises two profound questions, one specific to Fischer and chess and the other more general: What would Bobby Fischer's life and career have looked like had he received appropriate mental health services throughout his life? And is there a way for society to help troubled, often defiant prodigies become less troubled, without diminishing their genius and eventual contribution to society?

To understand Bobby Fischer's psychological makeup, it is important to understand his personal history, which began on March 9, 1943, when he was born in Chicago to Regina Wender, a Swiss native of Polish-Jewish heritage, and, most likely, Paul Felix Nemenyi, a Hungarian-born and -trained mechanical engineer who met Regina in 1942. He was also Jewish. (Hans Gerhardt Fischer, a German-born biophysicist whom Regina married in Moscow in 1933, is listed as Fischer's father on his birth certificate, but FBI records released after Regina's death and other documentation make it all but certain that Nemenyi was the biological father.)

Bobby had an older sister, Joan, born to Regina and Hans Gerhardt Fischer in 1937 in Moscow, where the couple was living at the time. Soon after Joan's birth, the marriage between Hans Gerhardt and Regina began to fail, and in 1939, Regina and Joan came to the United States without him. He never entered the U.S. and by all accounts was totally absent in the lives of the Fischer children. In 1945, Regina legally divorced him.

Soon after Bobby's birth, Regina Fischer moved the family from Chicago to Pullman, Wash., where Paul Nemenyi was then living, then to Moscow, Idaho, on to Portland, Ore., then south to Los Angeles, and on to the tiny town of Mobile, in the Arizona desert about 35 miles southwest of Phoenix. According to Frank Brady's classic biography of Fischer, *Profile of a Prodigy*, Regina took odd jobs to support her family until eventually gaining employment as a teacher in Los Angeles and Mobile.

From Arizona, the Fischer family moved to Brooklyn, N.Y., in 1949, where Regina, already a registered nurse, pursued a master's degree in nursing education at New York University. When Bobby was 6, his sister bought him an inexpensive chess set from a candy store, and together they learned the moves. Bobby had always liked games and puzzles, and initially his interest in chess was unremarkable, as he reflected years later to Brady: "At first it was just a game like any other, only a little more complicated."

It appears Fischer never adjusted well to the New York City school system. He was expelled from a public school in Manhattan when he kicked the principal, and he dropped out of high school. In contrast to this disinterest in school, Bobby developed an intense focus on chess. In fact, to say Bobby became obsessed with chess would be a wild understatement.

During Bobby's childhood and early adolescence, Regina consulted with, or had Bobby meet directly, three different mental health professionals. According to Brady, Regina spoke with Ariel Mengarini, a New York City psychiatrist and chess master, about curbing her son's "chess obsession," and Mengarini responded: "I could think of a lot worse things than chess that a person could devote himself to and … you should let him find his own way." Regina received a similar response from Harold Kline, who saw her son at the Children's Psychiatric Division of the Brooklyn Jewish Hospital.

World-renowned chess grandmaster and psychoanalyst Dr. Reuben Fine noted in his book, *Bobby Fischer's Conquest of the World's Chess Championship*, that Regina consulted with him soon after her son won the 1956 U.S junior championship at the age of 13. "He came to see me about half a dozen times," Fine wrote. "Each time we played chess for an hour or two. In order to maintain a relationship with him, I had to win, which I did. … My family remembers how furious he was after each encounter, muttering that I was 'lucky.' Hopeful that I might help him to develop in other directions, I started a conversation at one point about what he was doing in school. As soon as school was mentioned, he became furious, screamed, 'You have tricked me,' and promptly walked out. For years afterward, whenever I met him in clubs or tournaments he gave me angry looks, as though I had done him some immeasurable harm by trying to get a little closer to him."

This exaggerated, perhaps paranoid reaction to Fine's overture reflects a pattern in Bobby Fischer's interpersonal style that would be a hallmark of both his adolescent and adult behavior. But according to the recollections of both Brady and Fischer's brother-in-law, Russell Targ, Bobby never engaged in long-term psychotherapy with any mental health professional.

As Bobby grew into adolescence, he clashed with his mother frequently and directly. According to BBC journalists David Edmonds and John Eidinow, who wrote a book about Fischer, eventually Bobby and Regina could no longer live together, and in the fall of 1960, when Bobby was 17, she moved out of their Brooklyn apartment to live with a female friend in the Bronx. In an interview with journalist Ralph Ginzburg in August 1961, Bobby discussed the circumstances of his break from his mother.

Fischer: "After that [becoming an international grandmaster in 1958], I quit school."

Ginzburg: "How did your mother feel about that?"

Fischer: "She and I just don't see eye to eye together. She's a square. She keeps telling me that I'm too interested in chess, that I should get friends outside of chess, you can't make a living from chess, that I should finish high school and all that nonsense. She keeps in my hair, and I don't like people in my hair, you know, so I had to get rid of her."

This "break" was, in fact, anything but permanent or complete; Fischer and his mother would have an on-and-off relationship throughout his life. (Interestingly, as Bobby lay critically ill in a Reykjavik hospital, he was thinking of his mother, his brother-in-law wrote in his 2008 autobiography, *Do You See What I See?*)

According to Brady, the Fischer biographer, his mother was a concerned and devoted parent but could be domineering. It was clear she was highly talented, well educated and multilingual; in fact, after her children were on their own, Regina returned to Germany to finish medical school, earning both a medical degree and an eventual doctorate in hematology.

But raising Joan and Bobby as a single immigrant parent in the 1940s and 1950s was challenging, and Regina was constantly short of money. "Regina was financially desperate, so much so that, through a Jewish charity, she attempted to place her daughter, Joan, with another family," Edmonds and Eidinow wrote. But this arrangement fell through, the foster mother asking Regina to take Joan back. Interestingly, the foster mother became suspicious of Regina, having seen chemical formulas on documents that she had left among her

daughter's belongings, and reported her to the FBI, which in 1942 began surveillance that would last three decades.

It is not surprising that the FBI would investigate the foster mother's report about the chemical formulas. It was early in the Cold War, and Bobby's mother and presumed father at the time, Hans Gerhardt Fischer, had lived in Russia for an extended period of time; both had high-level scientific training. The resulting FBI reports on Regina Fischer and the two men in her life, Hans Gerhardt Fischer and Paul Felix Nemenyi, reveal no espionage. But they do shed light on the unusual psychology and behavior of the mother of America's greatest chess prodigy.

According to various entries in the FBI reports, eventually made public by journalists and biographers, Regina was bright and articulate but difficult to deal with. Soon after Bobby's birth, Regina received a mandated mental health evaluation after being arrested for disturbing the peace in an incident that occurred when Regina and baby Bobby lived at a Chicago charity for indigent single mothers, the Hackett Memorial Home. After Joan's foster arrangement fell through, Regina tried to sneak her into the facility, even though she'd been told there was no room for another child.

In its evaluation, the Chicago-based Municipal Psychiatric Institute diagnosed Regina as a "stilted (paranoid) personality, querulent [sic] but not psychotic." The FBI apparently also thought her troubled. According to FBI reports, the bureau, at one point, felt it had exhausted the usefulness of clandestine surveillance of Regina, noting, "It appears the only logical investigation remaining would be an interview of the subject, but due to her mental instability, this line of action is not recommended."

Regina Fischer had ambivalent feelings toward her son's chess career. Early on, she encouraged Bobby to broaden his interest and friendship base beyond chess. As Bobby's genius for chess became more apparent, however, Regina did all she could to support his passion. She was often involved in protests and demonstrations relating to Bobby's chess career and U.S. chess in general. In 1960, for example, she picketed the White House because the State Department refused the national chess team's request to play in the 1960 Chess Olympiad in East Germany. Interestingly, the person now alive who knew Regina and Bobby best, her son-in-law Russell Targ, remarked to me that "Bobby would never have become world champion without Regina."

Regina Fischer died of cancer in 1997 at the age of 84 in Palo Alto, Calif. Bobby's older sister Joan died of a cerebral hemorrhage a year later. These two losses, coming so close in time, would have a significant impact on Bobby's developing psychological state.

With Regina's death, her 750-page FBI file became publicly available. The first to read it were former *Philadelphia Inquirer* reporters Peter Nicholas and Clea Benson, and their investigative research is groundbreaking. A critical finding gleaned from the FBI report concerns the identity of Bobby's biological father. Though we cannot be 100 percent certain without genetic testing, there is a plethora of convincing documentary evidence — from the FBI file and from elsewhere — that Paul Felix Nemenyi, rather than Hans Gerhardt Fischer, was Bobby's biological father. At what point Bobby came to know the truth about his father is unclear. Suffice it to say, whether or when Bobby learned of his biological father's identity would also have implications for his sense of identity and psychological development.

From early childhood, Bobby Fischer was fiercely independent, eccentric and lacking in conventional social skills. Contemporaries often felt his conduct went beyond mere eccentricity. In his book on Fischer, psychoanalyst Reuben Fine reflected that for many years "chess players approached me with the request to try to help Bobby out of his personal problems. In spite of his genius, he was socially awkward, provocative, argumentative and unhappy."

Bobby's inner turmoil and frustration would at times erupt into violence. Mike Franett, writing for BobbyFischer.net in 2000, interviewed former Fischer friend and chess master Ron Gross, who described a car trip in 1957 when Bobby, sitting in the back seat, seriously bit fellow chess player Gil Ramirez on the arm. Gross reported that the bite marks were visible years after the incident. Later in his life, Bobby would also act out violently when, according to journalist Ivan Solotaroff, he assaulted a former Worldwide Church of God member who he felt had betrayed his trust.

Journalists Nicholas and Benson describe a meeting at the Marshall Chess Club in New York City in the late 1950s during which Bobby's emotional stability was discussed by the club's board of governors. "[N]o one doubted the teenager's talent. But his prickly behavior was alienating some of the wealthy sponsors whose support he would need to rise to the top," Nicholas and Benson wrote. "'Some of what he did was so outrageous it was decided maybe he had emotional problems,' says [Allen] Kaufman, [a chess master and Fischer friend] who attended the meeting. What to do? Board members talked about finding a psychiatrist. They considered Reuben Fine, himself one of the giants of the game. Then someone raised a question: What if therapy worked? What if treatment sapped Fischer's drive to win, depriving the United States of its first homegrown world champ? Meeting adjourned. No one, Kaufman recalls, wanted to tamper with that finely tuned brain."

Grandmasters Robert Byrne and Pal Benko told Bobby directly that he should consider seeing a psychiatrist. Their comments are supported by observations of odd behavior made throughout Bobby's life. In his *New York Times* obituary of Fischer, Bruce Weber noted that the chess champion made "outlandish demands on tournament directors — for special lighting, special seating, special conditions to ensure quiet. He complained that opponents were trying to poison his food, that his hotel rooms were bugged, that Russians were colluding at tournaments and prearranging draws. He began to fear flying because he thought the Russians might hide booby traps on the plane."

For his book, *Searching for Bobby Fischer*, which was made into a motion picture, Fred Waitzkin interviewed Gross, who shared the following memories of a fishing trip to Ensenada, Mexico: "He looked terrible … clothes all baggy, wearing old beat-up shoes. … Then I noticed that he was favoring his mouth, and he told me that he'd had some work done on his teeth; he'd had a dentist take all the fillings out of his mouth. … I said 'Bobby, that's going to ruin your teeth. Did you have him put plastic in the holes?' And he said, 'I didn't have anything put in. I don't want anything artificial in my head.' He'd read about a guy wounded in World War II who had a metal plate in his head that was always picking up vibrations, maybe even radio transmissions. He said the same thing could happen from metal in your teeth."

After winning the world chess championship in 1972, Bobby lapsed into a period of isolation and growing paranoia, manifested primarily in virulent and vitriolic anti-Semitism and anti-Americanism. These rants could be heard on radio broadcasts Bobby made in the Philippines and Hungary. Of course, Bobby's mother and his probable father, Nemenyi, were Jewish. Edmonds and Eidinow, the BBC journalists, wondered whether some of the roots in Bobby's hatred of Jews stemmed from rejection of his mother. In his 2003 mini-biography of Bobby, former 15-year world chess champion Garry Kasparov suggested Bobby's anti-Semitism might be related to his conflicts with Jewish-American grandmaster Samuel Reshevsky, as well as his dislike of other Jews involved in the chess community, including wealthy sponsors and journalists. Kasparov adds another interesting observation: "I think Fischer's anti-Semitism mania, which increased with the years, was largely associated with the domination of 'Soviet-Jewish' players. It seemed to him that they were all united against him with the aim of preventing him from becoming world champion. I remember Reshevsky telling me how, during the Interzonal tournament on Palma de Mallorca, with burning eyes Fischer informed him that he was reading a 'very interesting book.' 'What is it?' Sammy asked innocently. '*Mein Kampf*!' Bobby replied."

Regardless of the origins of Bobby's unspeakable anti-Semitism, his anti-Jewish rantings, in time, alienated the majority of former allies, friends and supporters. That's to say nothing of his comments following the

terror attacks of Sept. 11, 2001, made via a radio station in the Philippines. According to a 2002 Rene Chun article in *The Atlantic Monthly*, Fischer announced, “This is all wonderful news. I applaud the act. The U.S. and Israel have been slaughtering the Palestinians, just slaughtering them for years. Robbing them and slaughtering them. Nobody gave a shit. Now it’s coming back to the U.S. Fuck the U.S. I want to see the U.S. wiped out.”

The goal of a psychological autopsy is to assess the feelings, thoughts, behaviors and relationships of an individual who is dead. Such an evaluation is usually conducted without the benefit of direct observation, but often with more access to historical records and archives than would be available in a standard psychological assessment.

Check out the move-by-move re-enactment of "The Game of the Century" — Donald Byrne vs. Bobby Fischer, 1956

Bobby Fischer was not a patient of mine, and I have not had access to any mental health records on him or his mother, save for those uncovered by journalists who obtained FBI files under the Freedom of Information Act. It is inappropriate of me to proffer a formal psychological diagnosis of Fischer, and in writing this assessment, I am guided by the ethical code of the American Psychological Association, which says that practitioners in my position should “document the efforts they made and the result of those efforts, clarify the probable impact of their limited information on the reliability and validity of their opinions, and appropriately limit the nature and extent of their conclusions or recommendations.”

With those qualifications and limits well in mind, I have come to believe Bobby had a genetic vulnerability to develop a mental illness, and that this predisposition — in concert with early life trauma and the burden of relentless media pressure — eventually led to serious mental health problems. My mental-illness hypotheses should be considered speculative and in need of independent scrutiny from other mental health professionals, who, in time, will have access to expanded archival documentation on the life of Fischer and his family.

Still, enough is known about Bobby Fischer's life and family history — including the mental health history of his relatives — for me to reach some general conclusions.

Bobby's likely biological father, Paul Nemenyi, was highly intelligent, an established mechanical engineer and technical author who, at one point, collaborated with Albert Einstein's son, Hans Albert Einstein, on hydrology theory. But after emigrating from Hungary to the U.S. in 1939, Nemenyi had trouble adjusting, and at least a couple of his colleagues thought quite negatively of his character.

Nicholas and Benson uncovered documents in which Nemenyi was described as "an unstable and undesirable person" by a committee member of the Emergency Committee in Aid of Displaced Foreign Scholars and as "a misfit" by fellow Hungarian immigrant Theodore von Karman, a respected aeronautical scientist. Nicholas and Benson wrote that Nemenyi's colleagues told them that he always walked around with soap in his pockets, frequently washed his hands and was very careful not to touch door handles. He also had an aversion to wool and would go to work in the winter with his pajamas sticking out from underneath his clothes because, he said, he was layering to keep warm.

According to the FBI files, staffers at Jewish Family Services in Los Angeles, with whom Nemenyi was sharing his concerns about the mental health of Regina and Bobby in 1947, reported that the "agency did not completely trust Nemenyi, as they considered him somewhat of a 'paranoid type.'" The information on Nemenyi is limited, and the assertions in documents uncovered by Nicholas and Benson do not constitute definitive evidence of mental disorder.

The available anecdotal psychiatric evidence on Regina Fischer is more detailed. As I noted earlier, Regina's FBI file documented a diagnosis of "stilted (paranoid) personality, querulent [sic] but not psychotic." This diagnosis reflected the parlance of the mid-1940s and would be considered outdated today. Using the terminology of the current revision of the Diagnostic and Statistical Manual of Mental Disorders, Regina Fischer exhibited traits consistent with paranoid personality disorder, a non-psychotic mental illness. (Keep in mind, however, that Regina had good reason to be suspicious; she was, in fact, kept under surveillance by the FBI for roughly three decades. And, according to Regina's son-in-law, Russell Targ, the ongoing FBI surveillance hindered her ability to find steady employment.)

Assuming Nemenyi to be Fischer's biological father, the chess champion had two half-siblings: a sister, Joan, born to Regina Fischer and Hans Gerhardt Fischer, and a brother, Peter, who was born to Bobby's likely biological father, Nemenyi, and his wife. Like his father Paul, Peter was a gifted intellectual; he earned his doctorate in mathematics from Princeton and authored a respected book on statistics. According to Nicholas and Benson, however, Peter's "end was unhappy. Sick with prostate cancer, he killed himself [in 2002]. He had been living alone in a Durham, N.C., apartment crammed with statistics papers. Friends say they often spotted him pushing a collection of shopping baskets around town, wearing oven mitts for gloves." Again, there is not enough evidence to be confident of Peter Nemenyi's mental state throughout his life, but in his final years it was certainly problematic.

I have found no information suggesting that Joan, Bobby's half-sister, suffered from any mental disorder. In fact, it is clear that Joan was a reliable and consistent source of support for her brother, and it appears Bobby was as close to his big sister as he could be, given his interpersonal difficulties, general mistrust of others and paranoid tendencies.

It is my clinical intuition that Joan's death, coming only a year after their mother's passing, was a devastating loss to Bobby. His own grief process was further complicated: He could attend neither his mother's nor his sister's funeral for a very realistic fear that he would be arrested on arrival in the U.S. because of his violation of U.S. sanctions against Yugoslavia when he played his rematch against Spassky there in 1992.

A variety of authors have speculated about Bobby Fischer's mental state. For example, Valery Krylov, a specialist in the "psycho-physiological rehabilitation of sportsmen," who is cited in Garry Kasparov's mini-biography of Fischer, believed Bobby suffered from schizophrenia. Krylov had worked with former world chess champion Anatoly Karpov for two decades and arrived at his diagnostic conclusion based on an examination of correspondence to and from Fischer, and published articles related to Fischer. A more recent and popular diagnosis surfacing in the literature suggests that Bobby suffered from Asperger's Disorder.

In attempting to enhance the reliability and validity of a psychological assessment, clinicians form "differential diagnoses" that help to screen in and screen out potential "best bets" through a systematic, decision-tree process. In hypothesizing about Bobby's mental status, a differential diagnosis could include the Asperger's Disorder and schizophrenia (paranoid type) just mentioned, as well as paranoid personality disorder and delusional disorder.

Providing a detailed differential diagnosis of Bobby Fischer would require a much longer treatment of the topic than is possible here. I do provide such an expanded consideration in a book-length project in progress. For present purposes, suffice it to say that I believe Bobby did not meet all the necessary criteria to reach diagnoses of schizophrenia or Asperger's Disorder. The evidence is stronger for paranoid personality disorder, which the Diagnostic and Statistical Manual of Mental Disorders (DSM) says "may be first apparent in childhood and adolescence with solitariness, poor peer relationships, social anxiety, underachievement in school, hypersensitivity, peculiar thoughts and language, and idiosyncratic fantasies. These children may appear to be 'odd' or 'eccentric' and attract teasing."

In addition to paranoid behavior, in adulthood, Fischer clearly manifested the kind of non-bizzare delusions characteristic of the persecutory type of delusional disorder, which the DSM describes this way: "[T]he central theme of the delusion involves the person's belief that he or she is being conspired against, cheated, spied on, followed, poisoned or drugged, maliciously maligned, harassed, or obstructed in the pursuit of long-term goals. Small slights may be exaggerated and become the focus of a delusional system. The focus of the delusion is often on some injustice that must be remedied by legal action ('querulous paranoia'), and the affected person may engage in repeated attempts to obtain satisfaction by appeal to the courts and other government agencies. Individuals with persecutory delusions are often resentful and angry and may resort to violence against those they believe are hurting them."

This DSM language appears to describe Bobby's later life with a high degree of accuracy. Bobby did experience delusions that the Jews were out to destroy him, he was often involved in filing lawsuits (none of which he won), and he did turn violent on at least three occasions.

So my hypothesis about the course of Bobby Fischer's mental illness can be summarized in this way: Bobby's family history — particularly his mother's possible mental illness — modestly predisposed him to paranoid personality disorder. Bobby had no father figure and perhaps did not even know who his real father was until later in life; he was raised by a single mother experiencing financial hardships and daily stress from FBI surveillance. These circumstances added to Bobby's level of psychosocial stress and increased his vulnerability to mental illness. The stress and vulnerability were further magnified by his celebrity status and the unremitting media pressure that accompanied it.

As Bobby moved out of regular tournament play in the 1970s, he isolated himself, and his paranoia intensified. In some ways, the structure, demands and focus of chess tournaments may have confined or contained his paranoid thoughts and behaviors. In 1973, in what now seems almost a prophetic statement, Reuben Fine wrote, "Chess seems to have been the best therapy in the world for him."

The psychosocial stressors on Bobby intensified in the 1980s and 1990s. He was named in an arrest warrant the State Department issued in connection with his Yugoslavia "rematch" with Spassky; he suffered the untimely loss of his mother and sister; he was arrested in Japan in 2004 in connection with the 1992 warrant;

and he struggled for years to find a safe haven from U.S. arrest, finding one only in 2005, when he was granted full Icelandic citizenship. These varied and intense psychosocial stressors contributed to the presence of non-bizzare, persecutory delusions that were superimposed on a pre-existing paranoid personality disorder.

Over the half century since Regina Fischer first brought her son to the Children's Psychiatric Division of Brooklyn Jewish Hospital, the fields of psychology and psychiatry have advanced considerably. If Bobby Fischer had been born in this decade, he and his family would, at least in theory, have access to a variety of psychological assessments and interventions.

First, the daily stress Regina Fischer suffered as a subject of FBI surveillance could have been reduced with appropriate treatment. She might have received supportive and cognitive-behavioral counseling to help her develop coping strategies for dealing with that stress, and she might also have gained access to legal or financial support from civil liberties groups. Given Bobby's temperament, Regina could have benefited from parent training and support programs. Bobby's sister Joan might have benefited from personal counseling, given the burdens of her responsibility for troubled relatives. And clearly, family counseling — something far more likely to occur today than in the 1940s, particularly with working-class families — could have helped the Fischers as a group.

If the hypothesis posited in this article is correct — that Bobby suffered from a genetically predisposed paranoid personality disorder — he could today receive treatment that includes the long-term individual psychotherapy often required to make progress with patients exhibiting paranoid symptoms. Generally speaking, such patients are difficult to treat, given their mistrust of the therapist and therapy process.

With regard to schooling, a 21st-century Bobby Fischer would likely receive special support services, including individual and group counseling, which he probably did not receive at Public School 3, from which he was expelled, or at Brooklyn's Erasmus Hall High School, from which he voluntarily dropped out at age 16. Too little is known about Bobby's day-to-day behavior and affective state in elementary or high school to confidently recommend a particular medication regimen. But depending on the presence and intensity of coexisting symptoms — anxiety, depression and attention deficits in some subject areas — Bobby might well be prescribed a psychotropic medication.

And even though Bobby had an ambivalent relationship with his mother, he certainly could have used intensive grief and support counseling in 1997 and 1998, when his mother and sister passed away. Regina and Joan were Bobby's lifelong advocates, and despite his struggles and challenges, he felt emotionally close to them.

Would Bobby Fischer have become a world chess champion if he had been involved in long-term individual psychotherapy, family therapy and special support services and, possibly, been prescribed a psychotropic medication? This question I cannot answer.

Perhaps psychological intervention and the structure it provides would have stabilized Bobby's life and chess career. Psychological treatment could have equipped him with stress- and media-management coping skills; it could have provided techniques to bring his cognitive distortions and anti-Semitism under more control; it could have given him insight into his family history; and it could have supported him in developing and maintaining friendships and romantic partners.

If this cadre of interventions were successful, even in part, Bobby Fischer might very well have been world chess champion for a decade, rather than just three years, and a much happier person throughout his life.

But there is also the possibility that psychological intervention might have distracted Bobby from his chess focus and sapped the drive — the almost superhuman focus — that is a hallmark of genius. And this

possibility is at the center of the larger question that Bobby Fischer's troubled life raises: What can be done to help our most brilliant and talented citizens get the mental health treatment they need and deserve while ensuring that genius is not suppressed in the process?

Unfortunately, Bobby Fischer's dramatic rise to world pre-eminence and equally dramatic descent into isolation and mental instability is a life path not unique to him or to chess. To be sure, Paul Morphy, the New Orleans chess prodigy who played a century earlier than Bobby, also lapsed into a state of delusion, in his case centered on belief that he was being persecuted by his brother-in-law, the executor of his father's estate. But outside the field of chess, one can find countless examples of prodigies who succumbed to stress and intense career expectations. The musical genius of Michael Jackson, the acting and singing gift of Judy Garland, and the poetry and prose brilliance of Sylvia Plath represent but a few examples of promising talent undermined by mental health problems insufficiently dealt with, or left untended altogether.

Part of the psychological challenge for American "genius," in particular, lies in this country's cultural value system. It's a system that places high emphasis on individualism and individual accomplishment, rather than group effort. The chess, math or piano prodigy senses early on the extreme pride that family members, coaches and teachers have in his or her "unique" ability. At the same time, the prodigy also may learn that he or she will be excused for untoward behavior because adults are reluctant to take any action that might slow or derail the development of a "star." But that prospective star will likely also understand, very early on, the downside of life as a prodigy: Acclaim and special privileges continue only as long as genius shines.

Given stable childhoods and average genetic predispositions for dealing with stress, many prodigies manage such pressures well and become successful in their fields while achieving at least a semblance of life balance. Some prodigies, however — including Bobby Fischer, who had an unstable early family life, the pressure of early fame and, perhaps, a genetic tendency toward psychological difficulties — are not equipped to navigate life's challenges without counseling intervention.

I won't try here to describe all the programs and interventions that might foster psychological health in young people with special talents. Instead, I offer a brief outline of two primary areas in which early intervention could create better chances for our gifted and talented to achieve balanced lives.

Compared to young people who are identified, early on, as being at risk for learning disabilities or emotional-behavioral problems — to give just two of many possible challenges — children who have special intellectual or artistic talents are often assumed to be OK, psychologically, so long as their general academic performance is satisfactory. Because of their gifts, they are often left to their own devices and given few or no special support services.Because the pressures on the exceedingly gifted are obvious and too often debilitating or deadly, I suggest that schools take formal steps to identify talented students early on and then to provide them with support systems that promote their special talent while, simultaneously, helping them connect with other spheres of academic and social life. Such support services could include individual counseling, parent training, and support and group counseling with other gifted students.

I also favor the creation of mentoring — or "big brother" and "big sister" — programs for extremely gifted children. At an awards show last fall, young musical sensation Justin Bieber thanked an older friend — Usher, who'd also been a musical phenomenon at an early age — for acting as his mentor on professional, personal and life-balance issues. Such one-on-one mentoring can be very beneficial to young talents as they learn to navigate the challenges a life of high expectations and achievement poses, and I see no reason schools can't be more active in encouraging such pairings. There is already a wide literature on programs for gifted and talented youth and adolescents, and this is a critical area for continued research. But in some cases, at least, it may well take a genius to help a genius in the making.

http://www.miller-mccune.com/culture-society/a-psychological-autopsy-of-bobby-fischer-25959/

Outsourcing Science to Keep Results Untainted

State governments are using nonprofit organizations to conduct research that will guide future policy without being tainted by it.

By Matt Kettmann

A report on offshore oil platforms represented a leap forward for California, which is turning to the nonprofit sector to produce research rather than requiring government agencies do the work. (mikebaird/Flickr.com)

Earlier this year, the state of California released a 263-page report about the process of turning offshore oil rigs into reefs for the benefit of marine life.

For the California Ocean Science Trust, which spent nearly two years preparing the document, the June afternoon was a victory for scientists everywhere. Whether the environmentalists in attendance appreciated it or not, the publication of "Evaluating Alternatives for Decommissioning California's Offshore Oil and Gas Platforms" represented a leap forward for the Golden State, which is turning to the nonprofit sector to produce research rather than requiring government agencies do the work.

Not that the messengers of uncomfortable findings are any more shielded from criticism. "It is a nightmare," said one critic of the California Ocean Science Trust report, charging the document was incomplete and misstated the law and the issues. "At this point, it seems like it was a big waste of money."

The report was unveiled in Santa Barbara, Calif., which sits just a few miles from 20 of the state's 27 offshore platforms and has been the epicenter of the decades-long rigs-to-reefs battle between environmentalists and everyone else.

Although agencies have traditionally handled such a task, it's become increasingly apparent, especially in these cash-strapped times, that their analyses can be tainted by economic realities or political concerns. And

since those agencies are charged with implementing the policies that emerge from the research, it's an incestuous setup from the get-go, and at worst a fox-watching-the-hen-house arrangement.

What these nonprofits do, then, is handle the research very much like an academic institution, which includes assembling boards of experts to peer-review the work.

"That's the cornerstone of ensuring that the scientific process is in place," said Skyli McAfee, the director of the OST, which was created especially to act as the state's nonprofit research group for marine resources. "That's not the approach that agencies take. They're often driven by really constrained budgets. The questions they're asking are not necessarily the questions that need to be asked."

The rigs-to-reefs report was the state of California's first official foray into this new world, although the idea was developed nearly a decade ago with the California Ocean Resource Stewardship Act of 2000 and was further encouraged by the Pew Commission's Report on the Oceans of 2003. "Everyone wanted an accurate assessment of what the best options were," said McAfee of her charge with rigs-to-reefs. "What we brought was a bona fide process."

To do so, McAfee's team assembled all of the peer-reviewed science available, synthesized it into a comprehensive report, and bounced it off their own expert panel. They then developed an interactive digital program for policymakers reading the report to weigh their values against the information, with the different economic outcomes predicted depending on their selections. (Try out the interactive program by following the PLATFORM Model guidelines here.)

And OST's method had impact: Just a few months after it was issued, the state approved a rigs-to-reefs bill, citing the report in the final legislation.

Perhaps more importantly, the nonprofit approach also allows a broad range of funding, often from the stakeholders whose livelihoods depend on the outcome of the research. That was very much the case for the rigs-to-reefs report: The work was funded by Chevron (oil companies stand to save a half-billion dollars if platforms can remain), the Sportfishing Conservancy and United Anglers (recreational fishermen see the underwater rigs as fish meccas), and the California Ocean Protection Council and the Ocean Conservancy (both of which have focus on protecting marine resources).

While taking their money makes for easy controversy, McAfee explained that, once the checks are written, the stakeholders are kept entirely away. "We are known for having a pretty tight process that builds a firewall between us and any outside influence," she said. "Of course, we're obviously not doing this in a panic room or an iron mountain somewhere. What we do is be very, very transparent about the process and very clear in our correspondence with everybody."

Nonetheless, stakeholders — especially the environmentalists in Santa Barbara who have fought against any rigs-to-reefs idea for years — felt overlooked, and argued that the public should have been more involved in the process. But McAfee said that locking them out was exactly the point. "We were just trying to spell it out so that everybody gets to see exactly what the facts are and then, it's perfectly appropriate for stakeholders to hash it out in the policy arena," she said. "Our sole business is to provide as bulletproof a process as possible, to do the very best we can to eliminate bias is very valuable to the state."

The California approach caught notice up the coast in Oregon, where Robert Bailey, manager of that state's Coastal Management Program, recently commissioned a global survey of similar programs.

"It's become really clear that Oregon doesn't have the resources to do the kinds of research monitoring and information development that's needed to do a good job on marine ocean planning and management,"

explained Bailey, whose process started after the state got flack for entertaining funding for marine reserve research from the Packard Foundation, which fishermen believed would have biased the state's agenda against them. "It took an ungodly amount of effort to get people's heart rates under control," he said laughing. He added that this mistrust of funding — at a time when private donations are on the rise while government money is dwindling — puts agencies like his in the undesirable middle. "We would have saved a lot of time and energy if such a mechanism had been in place." So his mission became discovering "ways Oregon could build a structure to enable us to receive funding from a variety of sources but use the funding to fund research in an open and transparent way."

He hired the Berkeley, Calif.-based firm T.C. Hoffman & Associates to conduct the survey, and they found that, in marine issues alone, the Virginia Institute of Marine Science, Chesapeake Bay Foundation and Gulf of Maine Council on the Marine Environment are all examples of government agencies relying on nonprofit research along the East Coast.

Indeed, this arrangement is essentially what the National Academies have been doing since the 1800s, and it's also prevalent in other fields, such as health research, where the American Academy of Pediatrics and the American Cancer Society are longtime research leaders. And then there's SRI International (formerly the Stanford Research Institute), which has been doing this sort of work for 60-plus years for such diverse agencies as the Air Force, Department of Education, National Science Foundation, and the states of Connecticut, Florida, Illinois, Iowa, Kentucky, Maryland, Oklahoma, Pennsylvania and Virginia.

What's new, however, is for states to be actively creating and fostering their own nonprofits to handle this work.

T.C. Hoffman's principal, Tegan Hoffman, believes it's a positive shift. "I think 'outsourcing' science can have great value," she explained, so long as the research is kept separate from the politics and funding. As part of her research for Oregon, Hoffman interviewed a number of resource managers around the world. "They talked about having scarce financial resources and human capacity to finish all of the tasks that they wanted to complete for science-based decision-making," she explained. "This is a real issue, especially as state governments continue to cut programs."

The traditional way of having agencies handle the research — with an eye on outcome more than on data — is problematic, Hoffman said.

"Policymakers make decisions, design policy and negotiate and solve problems by taking into account the interests of many stakeholders. Science should not be 'handled' by them, but rather should be informing them so they can assess trade-offs, emerging issues and the costs and benefits of their policies."

Hoffman's research was welcomed with open arms in Oregon. Bailey believes that the state Legislature will create the Oregon Ocean Science Trust in early 2011. "We hope to establish a very clear firewall between objectives, the funders and the results of the science," he said. "Trust is really the operative word in many ways."

Another significant player in this shift is Amber Mace, the former executive director of the California Ocean Science Trust and current executive director the California Ocean Protection Council. She tipped Oregon to the idea and has been a strong proponent of the process in California.

Nonetheless, Mace wants to be clear that she and her colleagues are not discounting the work of government employees. "We have some excellent agency scientists with the state and federal systems and they do a fantastic job, but in any kind of scientific process, you have multiple experts from outside that bring balance and credibility to the integrity to the work the government is doing," she said.

"This ensures that we have the most accurate information to inform decision-making so the decisions are balanced in terms of all the factors that weight into the decision. We want to really be using the best available science to have the greatest understanding with the least amount of uncertainty."

But Mace also understands that science is not the 'be all and end all' when it comes to policy. "While in graduate school training to be a scientist, I thought that science alone was where decisions should come from," she explained. "But my thinking has since evolved to understand that science informs decision-making as do many other factors. It is critical that science is included, and that the science is sound, but it doesn't *make* the decision."

At least now, however, policymakers in California and likely Oregon will be sure that the science they have — at least when it comes to marine resources — is objective and clean, so those decisions will be based on reality rather than politics.

http://www.miller-mccune.com/politics/outsourcing-science-to-keep-results-untainted-25937/

Going Up? Vertical Farming in High-Rises Raises Hopes

An angry Mother Nature and increasing urbanization have led Columbia's Dickson Despommier to urge agriculturalists to consider tilling vertical farms in high-rises. A Miller-McCune.com interview.

By Arnie Cooper

Proposed vertical farming designs presented in "The Living Landscape: Farming the Urban Skyline" by Blake Kurasek. (www.verticalfarm.com)

With the worst drought in 70 years decimating northern China's winter wheat crop and the soybean harvest down 40 percent in Argentina, Brazil and Paraguay this year, the world food crisis continues to expand — even as increased demand for plant-based biofuels further strains agricultural lands. What's more, by midcentury an estimated 80 percent of the world's population will live in urban areas. Feeding these new city dwellers will require creative ideas to reduce food miles and the associated energy use.

One solution may lie in Dickson Despommier's vertical farm — a 30-story crop powerhouse the size of a Manhattan block that, in theory, could produce enough food for 50,000 people.

The concept took root in 1999 while Despommier, a parasitologist, was teaching medical ecology at Columbia University's School of Public Health. Halfway through the semester, his students, tired of exploring

the health risks associated with environmental damage, asked him if they could do something more "uplifting."

"OK, it's your money, and it's your time," Despommier told them. "Pick a subject and I'll be glad to support you."

After choosing rooftop gardening, Despommier challenged the class to see how many Manhattanites they could feed on a 2,000-calorie daily diet. With only 13 acres of usable rooftops, the students could only cover 2 percent of those 50,000 people. "Not good enough," Despommier responded.

Sensing their frustration, Despommier flippantly suggested growing stuff indoors — vertically. By accident, the 69-year-old had found a new calling, and by 2001 the project had evolved into a vertical farm. Using grow lights and conveyor belts powered by renewable energy sources, Despommier and his students came up with an outline in which approximately 100 kinds of fruits and vegetables would grow on upper floors with lower floors housing chickens and fish subsisting on the plant waste.

This may all sound like pie in the sky, but Despommier says his skyscraper farm has aroused the interest of scientists and investors around the world. And though the project is still in the blueprint phase, if it pans out, not only will large numbers of individuals be able to source their food locally, but ecosystems destroyed by years of exposure to toxic pesticides will also be restored.

Miller-McCune.com: You believe that we need to systematically abandon farmland. Why?

Dickson Despommier: Right now the agricultural footprint of the Earth's population is the size of South America. That's an enormous amount of land that we set aside for farming. We're at 7 billion people. In another 40 years, we'll be at 10 billion. To continue farming as we do now, we'll have to set aside new land the size of Brazil. That would lead to the collapse of numerous ecosystems on this planet, and we would go with it.

People say, “Food in buildings? How unnatural? The natural thing is to use the land.” Well, I hate to break this to you, but that’s equally unnatural. That farm used to be an intact ecosystem until we transformed it. Vertical farms will restore the natural capital of the land and provide our food at the same time.

M-M: So even if there weren’t a starvation issue, you’d still advocate restoring farmland?

DD: The biggest problem the Earth’s human population and other animals and plant populations face right now is the *rapidity* of climate change.

Climate change will happen regardless of what we’re doing, but the speed at which it occurs is *our* fault. That’s the part we control by the emissions, primarily from our C02-producing combustion engines and from our animal husbandry via methane production. The part we can address the most is carbon sequestration. How do we take that carbon out of the atmosphere? The Food and Agricultural Organization of the U.N. says the best way to do it this to allow trees to regrow in places they used to be.

M-M: You’re a parisitologist. What’s the connection to vertical farms?

D-D: Half of the world still uses human feces to fertilize crops. That’s the best way I know of to acquire parasitic infections, particularly worm infections, which take a great toll on human health. If the world could learn to grow its food differently, we could cut off the lifecycles of these incipient parasites. Also, modern farming methods that rely on chemical pesticides and herbicides have created additional health risks that are only now being investigated by epidemiologists and toxicologists.

M-M: But what about organic farming? Won’t that help offset the bigger problem?

DD: You simply can’t farm organically on a scale large enough to solve the rapidity of climate change. There just isn’t enough good soil out there. In fact, the FAO says the biggest detractor for agriculture nowadays is soil erosion that occurs either from wind, because of droughts — and there are tons of drought situations out there — or from flooding. Both situations result in topsoil loss, the biggest reason for the world’s current agricultural predicament.

M-M: OK, but what about the pleasure and physical benefits that traditional farming brings?

DD: I love that aspect of farming, and I wish that life could continue unchanged, but to be very honest, the world is transforming before our very eyes. Ask the average farmer. They’ll tell you they’ve had their worst droughts and floods in their history — within recent memory.

We have to face up to the fact that climate disruptions are becoming *more* rather than *less* frequent. We’ve only had two F-5 tornadoes in the world and they both struck in the American Midwest just during the last five years. Wipe a farmer out for three years in a row and they’re out of business.

Take the farmers in India, where I just visited in February. All I kept hearing about was the failure of the monsoons. They used to last four months, with relatively gentle rain recharging the aquifers, which provided water for a whole year. Now the monsoons come for two and a half months. It rains like crazy and though you get the same amount of water, everything gets washed away. The cotton failed this year; wheat last year.

M-M: So how do vertical farms offset this?

DD: I’ll give you two choices. First one is you get to control everything from start to finish. The second is you get to control nothing. Which one do you pick? Choosing the first one is natural, but farmers don’t have that choice. They can’t control the weather. Our farming technology includes hydroponics, which uses 70

percent less water than normal agriculture. We also use aeroponics, which uses 70 percent less water than hydroponics. Indoors, we can control everything including temperature and humidity as well as nutrition.

M-M: How does it work?

DD: Each floor will have its own watering and nutrient monitoring systems. There'll be sensors for every single plant that tracks how much and what kinds of nutrients the plant has absorbed. You'll even have systems to monitor plant diseases by employing DNA chip technologies that detect the presence of plant pathogens by simply sampling the air and using snippets from various viral and bacterial infections. It's very easy to do.

Moreover, a gas chromatograph will tell us when to pick the plant by analyzing which flavenoids the produce contains. These flavenoids are what gives the food the flavors you're so fond of, particularly for more aromatic produce like tomatoes and peppers. These are all right-off-the-shelf technologies. The ability to construct a vertical farm exists now. We don't have to make anything new.

M-M: So who's going to pay for this? Where is the money going to come from?

DD: There are governments out there willing to get involved because they lack a readily available food supply since they don't have any soil. Jordan has expressed a big interest. In those places, I'd enlist federal support.

We'll also use private investors of course, but to start doing this off the bat would be impossible. You experiment, work out all the kinks, find out where the weak points are and you try to strengthen them. You do good science, which means starting with prototypes and putting them into the hands of experts who then tell you how to save money, what building materials to use and the kinds of crops that would be most effective.

M-M: What are some of the biggest challenges with this endeavor?

DD: Coordinating all these systems into an engineering schema that allows each floor to act independently yet integrated into the flow of water, nutrient delivery, planting, growing and harvesting. All of that needs to be worked out. That's why we're advocating for a prototype vertical farm first to be located perhaps in a very gifted agricultural school's campus, next to a very large city, so you could use the city as your experimental playground for integrating versions of vertical farms into restaurants, schools and hospitals, etc.

M-M: You say that if vertical farming succeeds it'll establish the validity of sustainability irrespective of location.

DD: For the first time in the history of human existence, farming won't have to rely on soil types. You'll be able to build a farm in the middle of a desert or in Iceland. You'll put it wherever you want and people will live there as a result, because you can generate food and energy in those places. Now the water has to be obtained from the ground but if you dig deep enough you'll find it. You don't need a lot for hydroponic farming. That's why it's worth it no matter what you do have to do to drill for it.

http://www.miller-mccune.com/science-environment/farming-in-high-rises-raises-hopes-3705/

Saving Forests with a Sense of Place

While visiting Oaxaca's forestry cooperatives, Kristian Beadle considers the link between remembering the dead and managing living resources — including new climate policies to reduce deforestation.

By Kristian Beadle

Arbol de Tule, a 1,500-year-old tree near Oaxaca City. (Kristian Beadle)

I was in the southern Mexican state of Oaxaca during one of Mexico's best-known traditions, the Day of the Dead.

The somber Panteon General, Oaxaca City's largest cemetery, had been transformed into a carnival. A mariachi band played next to walls covered in candles reflecting the dead; yellow marigold flowers called *cempasúchil* decorated grave sites and adorned the altars that sprung up around the city. Offerings of food and drink for ancestors, who appeared in fading black-and-white photographs, were everywhere.

Although part of the Catholic All Saints and All Souls days, the creativity of Dia de los Muertos (Day of the Dead) arises from indigenous traditions. "Similar to Halloween," noted an American friend, watching the costume parade heading to the cemetery, "but with more heart, less sex and candy." Indeed, the intention of the ceremony is to invite the spirit of relatives past to celebrate with the living. The taboos surrounding

mortality emerge from the dusty closet … "Just as our relatives died, so will we." It can be an oddly relaxing thought.

I considered the social implications of this collective mentality. With heightened awareness of past and future generations, might people's reason for living go beyond themselves and today? Are they more motivated to care for their community to ensure the well-being of the future?

Meanwhile, I had sat under a tree of epic proportions just 20 minutes from Oaxaca City. The Arbol de Tule, at least 1,500 years old, is the most ancient living being I've ever seen. Reportedly the widest tree in the world (its diameter is 38 feet, with a circumference of 119 feet), this particular Montezuma cypress, or *Taxodium mucronatum*, makes human lifespans seem like blips.

With all this in mind after the early November holiday, I drove into the mountains above the valley of Oaxaca, where several forestry cooperatives are becoming famous for their conservation of forests and balanced community development.

"About 60 percent of Mexico's forests are community-owned, and Mexico is now a world leader in sustainable forest management," explained Luis Ubiñas, the president of the Ford Foundation, addressing one of the main themes of the Cancun conference on climate change. "These forests aren't guarded by signs that prohibit use, but rather by giving local communities rights to the property and its management."

The mountain villages of Sierra Madre in the state of Oaxaca are amidst some of the most biodiverse pine-oak forests in the world. According to World Wildlife Fund, the area contains nearly 40 percent of endemic vertebrates of Mesoamerica, the bio-cultural region stretching from central Mexico to northern Costa Rica. This diversity comes from radical topography and climatic differences: the rugged terrain climbs from 3,000 feet to a peak of 11,000 feet, while rainfall varies from 28 inches to 80 to 160 inches a year.

Communities here rely on corn, cattle and forestry — creating an inherent tension over deforestation and survival. Although a lack of access helps keep the forests relatively well preserved, there is also a conscious philosophy of conservation.

In these mountains sits the tidy town of Ixtlán de Juarez, which international forestry experts say has "become the gold standard of community forest ownership and management," as *The New York Times* has written. I met the general manager of the town's forestry cooperative, the well-spoken Jesus Paz. He showed me their factory on a Saturday morning, which was quiet except for the wind howling outside. Paz explained that when the state-run company's concession expired in 1983, the community regained autonomy of a nearly 50,000-acre forest.

Now they have one of the most advanced wood processing plants in Mexico, and both the logging operation and on-site furniture factory are certified with the Forestry Stewardship Council, the highest industry standard for sustainability. "The certification cost is high, but it has improved our efficiency with erosion control, tree-planting and safety," Paz said. "Plus, it was the right thing to do."

Their efficiency allows them to preserve the vast majority of their forest: a reserve of nearly 40,000 acres. Although certified wood doesn't fetch a higher price in Mexico, the government agency that contracts them to build school furniture was sold on the idea and now requires certification for new contracts — a new competitive advantage.

The cooperative is run by an assembly of 384 comuneros, or communal owners, who elect managers and make decisions democratically; they are drawn from the indigenous Zapotec people. The majority of the comuneros also work for the company, which has now expanded into seven businesses, including a furniture

store, ecotourism resort and a high-tech nursery. The comuneros are the original owners or owner-heirs of the forest land, based on post-Mexican Revolution (1912-1918) land reforms that began granting land ownership to millions of peasants.

This apparently has created a private incentive for stewardship. As cited in a 2010 report to the United Nations Forum on Forests, "151 communities are protecting over a half million hectares of forests, almost half of which are in Oaxaca."

Beyond the town square and church was the road leading to Ecotur-Ixtlán, the cooperative's ecotourism center. The mountain air was cutting through my double layer of sweatshirts, the sky piercing blue through the canopy of pine trees. One of the guides, Rodrigo, told me about his work: taking tourists on hikes to the Mesophyllic Forest, an area of near-permanent humidity in a nearby summit containing unique species.

"I used to work in logging, but I like this better," Rodrigo told me from beneath a frayed beanie. "I learned the trade by sneaking into presentations by ecologists staying at our lodge. For sure, it has changed how I think, and my decisions in the assembly. We want to do what's best for future generations, but sometimes we don't know how." Being a comunero himself, Rodrigo soon excused himself. The assembly meeting was at 5 p.m., and I was left to ponder his meanings under the trees.

Although it has become trite in some circles, the Great Law of the Iroquois still holds weight: "In every deliberation, we must consider the impact on the seventh generation … even if it requires having skin as thick as the bark of a pine." The multi-generational philosophy of indigenous people, it is said, makes them better stewards of the land for the benefit of all. Yet, how much of that statement is true, and how much is based on the romantic ideology of the "noble savage"?

The forestry comuneros I spoke to constantly mentioned their desire to preserve the forest for future generations. "It was the right thing to do," Paz said about certifying their operation with the Forest Stewardship Council. That essential philosophy is shared by other cooperatives in the Sierra, collectively called the Alianza EcoForce.

Genuine empathy for multiple generations is present in many cultures, and may not be reducible to indigenous ethics. The fishing cooperatives I visited in Baja's Vizcaíno Peninsula, for example, also showed a remarkable vision of resource conservation.

By virtue of their community orientation and legal status, the fishing and forestry cooperatives share a common sense of long-term ownership of their resources. They have an incentive to sustainably manage their region's marine life and forest life because they feel secure about retaining rights to zone into the future. Another element that helps build multi-generational thinking is the length of time people plan to spend in a community. The indigenous worldview that sees interconnections in natural processes also helps this thinking; but in itself it may not be sufficient to foster long-term stewardship.

REDD and Financing Forests

Enter the international discussion on forestry and climate change, strongly present in the ongoing U.N. Climate Change Conference in Cancun. Early in September, Oaxaca City was host to a forestry workshop for Latin America and the Caribbean, serving as a preliminary to the Cancun conference. The workshop focused on climate policies of REDD, the emerging system for Reducing Emissions from Deforestation and Degradation, which is basically a way to value and finance forest preservation.

Burning forests accounts for roughly 12-17 percent of yearly global greenhouse gas emissions, almost as much as the transportation sector (a 2009 study published in the journal *Nature* indicates the contribution is

about 15 percent when peatland degradation is included). The United Nations Framework Convention on Climate Change — the body running the Cancun conference — considers it the most viable climate mitigation option in the short term.

REDD seeks to value the carbon stocks of forests to make them more profitable alive than dead — that is, not cleared for a palm oil plantation or cattle farming. To be successful, carbon prices need to infuse more dollars per acre (measured in carbon tons) to be paid to locals for keeping forests standing, instead of being chopped for agricultural uses. This approach doesn't count the biodiversity effects of preserving forests, which would be a tremendous collateral benefit.

One concern is finding a common language between multinational financiers and forest dwellers, so that equitable benefits go to locals and foreigners. Another concern is whether the price of carbon is sufficiently *stable*, achievable under a regulated market, but less likely in today's voluntary carbon market. Despite these speed bumps, the market is taking notice of forest conservation. As described in Yale e360, Merrill Lynch has invested $9 million one Sumatra project, and Brazil is creating mechanisms to raise $21 billion by 2021.

Forestry workshop participants in Oaxaca visited and were likewise impressed by the cooperatives in the Sierra but wondered if their successes can translate to other places. After all, the unique communal ownership that emerged from Mexico's particular agrarian reforms (despite its flaws and limitations) plays a key role in these cooperatives' business structure, and may not be replicable.

Nevertheless, the elusive concept of "forestry governance" may boil down to some down-to-earth principles: As outlined above, when a sense of long-term ownership is combined with sound organizational structure, the basic incentives for resource stewardship are in place.

A 2009 study analyzed 80 forests in Asia, Africa and Latin America and concluded that when local communities manage and own forests (which they call "rule-making autonomy and ownership"), there is more carbon sequestration and forest protection. That approach may be just as effective as managed protected areas, but with fewer costs. The study helped dispell the myth that local communities are unable to manage their resources (i.e. are dependent on outside companies and "experts"). I believe this is part of a shift in thinking toward more local control of natural resources.

The cooperatives' long-term well-being requires the conservation of their forests.

This lesson can be applied beyond forestry and discussions of REDD. I drove the long, windy road back to the coast, wondering if the principles from Mexico's cooperatives — long-term ownership and local management — might influence the future of forests globally.

Perhaps the principles that unite stewardship with community values can work in elsewhere. Like the meanings of the Day of Dead, even if they are not universal, they are at least inspirational, and may help us see through the "smokescreen" of forest management.

http://www.miller-mccune.com/science-environment/saving-forests-with-a-sense-of-place-25911/

Fostering Strengths, Not Just Red Flags

Once they learned how to talk like real people, workers with Illinois' child welfare agency started spreading the word of strengthening families.

By Emily Badger

(Courtesy the Carole Robertson Center for Learning)

The Carole Robertson Center for Learning on the near West Side of Chicago cares for children as young as 6 weeks old while their parents — 78 percent of whom are single mothers, 63 percent of whom live at or below the federal poverty line — are at work, sometimes for as long as 12 hours a day. Babies crawl across the floor of the nursery, a bright room lined with cribs and so fastidiously cleaned that adults must don disposable booties over their shoes just to enter.

The infants graduate across the hall of the $4 million extension to one of four rooms designed specifically for the day care and development of 15- to 36-month-olds, who sit studiously tackling Play-Doh pizza and group sing-alongs. At age 3, those children move upstairs, where the games grow more complex and the wall art more impressive. If they stay with the center, they'll one day move to the older building next door that houses the computer lab, music room, art studio and pool table that cater to elementary and high school students.

On a morning just before the start of the school year, two dozen 8- to 10-year-olds were in the art studio scrawling geometric designs across construction paper. "Some of them have been with us since they were infants," said Gail Nelson, the center's chief executive officer.

The Carole Robertson Center, which has three sites in this neighborhood, was one of those visited by the Center for the Study of Social Policy when it scoured the country for early child care centers that — knowingly or not — seemed to be doing a good job of supporting families less likely to mistreat their children.

"We have always operated on the assumption that all parents love their kids, and all parents want to do right by their kids," Nelson said. "We live in communities at risk of a lot of things that are mostly caused by poverty and family stress, and it's not caused by anyone's bad intentions."

As with many of the sites CSSP studied, the Carole Robertson Center (named after one of the four girls killed in the 1963 Birmingham, Ala., church bombing) did not explicitly think of itself as working to prevent child abuse. But in 2008 when the staff researched its records for the CSSP, Nelson found that the center had made but nine calls to the child abuse reporting hotline in the previous 10 years. And only one of them resulted in the removal of a child.

That, Nelson says now, is remarkable for an organization that cares for 700 children under 18 every day, while employing 185 adults who are required by law to report signs of abuse or neglect. The success is a result, Nelson believes, of preventive involvement by child care workers who know intimately not just every child at the center, but each of their parents as well.

The programs that almost inadvertently support that goal developed organically over time, not with any grand strategic plan or sociological study in mind. The center initially offered after-school programs for middle-school and older children in the mid-1970s. Parents who moaned that they couldn't afford gym memberships later asked to use the center's facilities after-hours for adult volleyball. They took turns watching each other's children in an adjacent room.

Not long after that, Nelson says parental gossip in the hallway got a little bawdy one night, and staff moved parents into an empty classroom. One woman sat down and pulled out her knitting needles, and the center's first parent support group — "stitch 'n' bitch" it was called — was born.

Today, the Carole Robertson Center offers everything from individual developmental assessments for children to adult education classes, family cultural outings and social services — each of which, in an overlapping way, helps build the "protective factors" CSSP has identified that help reduce child maltreatment.

"It all really developed from the ground up – none of it was imposed on anyone," Nelson said. "It just sort of grew in response to what people said they needed. And that's really the description of the whole agency."

The state of Illinois has been one of the most enthusiastic adopters of CSSP's "strengthening families" model, from the early child care centers Judy Langford initially targeted to the state welfare agencies, schools and learning networks to which the ideas have spread.

Erwin McEwen and his eight siblings were raised in the now demolished Robert Taylor Homes public housing project on Chicago's South Side. "I looked at those protective factors," he said of CSSP's research, "and I thought about how they played out in my family as a child that got me to where I'm at."

His parents had the "resiliency" to keep their children isolated amid stressful challenges — a lost job, neighborhood violence — and the "social connections" to get them out of the city to spend summers with family in Mississippi. Today, McEwen is the director of the Illinois Department of Children and Family Services, an agency that has renewed its mission around CSSP's ideas.

McEwen tells people his agency doesn't want to raise children; it wants to protect them by strengthening their families. This is a direct echo of CSSP's mantra.

"It puts into child welfare, and the child abuse equation, protective factors which have never been there before," McEwen said. "It's always been risk factors, risk assessments, predicting harmful outcomes."

The shift is particularly welcome, McEwen said, among caseworkers who lament being viewed simply as antagonists who snatch up children when nothing else can be done. The Illinois DCFS now trains every caseworker and private contractor in the protective factors — in the idea that they must look for and foster a family's strengths, and not just its red flags.

It's not a coincidence, McEwen suspects, that the state has one of the lowest child removal rates in the country.

"What Strengthening Families did was make us look at this thing as an adoptive challenge," McEwen said. "That means folks are going to have to change behavior, are going to have to change how they speak about things, are going to have to change attitudes – which is a lot different than saying, 'OK, here's the new checklist, go out and do it.'"

About five years ago, the Illinois DCFS began funding a campaign aimed at spreading the protective factors beyond agency professionals and child care providers to one group CSSP had not originally made plans for: parents.

CSSP gave a local presentation on the protective factors to an audience that included several parent leaders. Afterward, one father stood up to object.

"They went through a whole beautiful research-based spiel and threw it out there," recalled Letechia Holmes, one of those parent leaders, "and [this father] said, 'I don't get this. You've got something good that's for families. Parents should be a part of this. Just give it to us straight.'"

The "protective factors" had a clinical jargon problem.

As several other states have since done as well, the Strengthening Families Illinois network — which includes the Carole Robertson Center — set about repackaging the ideas into more accessible language.

"We really tried to get underneath what each of these meant, what does 'resiliency' mean, and how would you talk about it?" said Lina Cramer, a Strengthening Families Illinois consultant (and mother). "Nobody talks about how, 'Oh, I don't feel too resilient today.'"

The group settled on six more digestible messages: Parents must be strong and flexible. Parents need friends. Being a great parent is part natural and part learned. We all need help sometimes. Parents need to help their children communicate. And parents must give their children the love and support they need.

Those tenets were packaged under a single campaign framed with the help of a marketing firm: "Love is not enough to keep your family strong."

"We decided to put it right up there — it's not about whether we love our kids or not, because we love them," Cramer said. "But we don't always know what to do, or we're at our wit's end, or life happens."

That message is certainly more forgiving — and universal — than "stats suggest you're at high risk for abusing your child; please come to an intervention."

Strengthening Families Illinois now runs a series of "parent cafés" across the state where trained parent leaders, like Holmes, lead other parents through discussions about the protective factors. The groups talk about parents taking care of themselves, as well as their children. Clinical professionals are replaced by the wisdom of other parents. And there's usually pizza.

About 4,000 parents in the state have so far come through a café. Dara Griffin turned up for one after seeing a poster.

“It said ‘free child care’ and ‘free dinner,’ and that’s all I needed,” she said. “It was the reason I went. It didn’t even matter what the topic was. I just needed a break, and other adults, some adult conversation, a break from my kids. A day where I didn’t have to cook dinner or think about what dinner was going to be.”

At the time, she had three children under 7. Now she leads cafés herself.

Langford never envisioned this outgrowth of a project that at first narrowly focused on places like the Carole Robertson Center.

“The parent side of it was a wonderful, welcome aspect,” Langford said, “and I think it has as much potential to really change the way people think about child abuse and prevention as anything that any agency or anybody else could do.”

http://www.miller-mccune.com/culture-society/fostering-strengths-not-just-red-flags-26134/

What's High School For?

December 16, 2010
By Glenn Sharfman

We all want more young people to attend college. Who would argue with that? Politicians and educators at all levels extol the obvious virtues, from enhanced earning potential to a greater satisfaction in life. One increasingly popular way to encourage college attendance is through dual enrollment, in which students take courses in high school for both high school and college credit.

In theory, dual enrollment enables high school students to accrue college credits for very little cost and imbues them with a sense of confidence that they can complete college work. If students can succeed in college classes while still in high school, conventional wisdom holds, they will be more likely to matriculate at the postsecondary level.

In Indiana, dual enrollment is encouraged at the highest levels, with state Education Secretary Tony Bennett maintaining that at least 25 percent of high school graduates should pass at least one Advanced Placement exam or International Baccalaureate exam, or earn at least three semester hours of college credit during high school.

In reality, though, dual enrollment may do more harm than good.

Increasingly, students are turning up at college campuses with an impressive number of college credits, thereby bypassing introductory college courses. The problem is that high school is not college and completion of a dual enrollment high school class is not always a guarantee that students have learned the material. For instance, students earning a “C” in a dual enrollment English class in high school with a high school teacher are exempt from a basic writing course in college. They would immediately be placed into upper-level college classes where faculty members assume a basic skill level the students might or might not possess.

As a result, classes that used to be termed “college-prep” are now seen as college proper. The rationale is that if high schools offer the same psychology class, for example, as colleges and cover similar material, these students should be earning college credit. Dual enrollment proponents argue that high school teachers are trained by a university and follow the same syllabus. In practice, however, courses covered in a high school setting on a high school calendar are often vastly different in practice.

This is not a criticism of high school teachers. Many are excellent educators and care deeply about students. But they often teach more classes than college faculty do, have myriad extracurricular responsibilities, and lack the requisite training that enables college faculty to introduce best practices in the field. In contrast, college faculty members expect a higher level of work from students, including having them study independently, write in the discipline and be exposed to the latest research. They are less likely to offer extra credit, or evaluate students based on an inflated high school norm.

High school teachers and college faculty have different roles, equally important. The line between the two shouldn’t blur.

Even the classroom dynamic is different. High school students, especially sophomores and juniors, are not like college students. A collection of 15-, 16-, and 17-year-olds are normally at a different stage of intellectual and moral development than are college students. Treating a high school student like a college student does not always do them a favor.

It is too soon to know how this phenomenon of early college will play out, but my fear is that students will be hurt. In a rush to adhere to federal and state initiatives, high schools have opened dual enrollment classes to as many students as are willing. What student would not be interested in taking college classes for little cost with their own high school teachers in a familiar setting?

We have a concrete example at Manchester College that shows how this new program may impair students. Manchester admitted a student from a celebrated articulation program between an Indiana two-year college and a high school with a strong academic reputation. This student, as a sophomore in high school, earned a "C" in a "college" English course, which exempts her from our basic English 111 College Writing class. Even though her ACT score indicates her writing skills are deficient, we are limited in what we can do.

Like many students who have already passed a "college" class, she thinks she already has the necessary writing skills to be successful in college. We know she very likely does not. Our willingness to increase student access by accepting transfer credit means that, without taking this student's credits away, we cannot help her with her writing. Instead, by virtue of an average performance as a high school sophomore, this student will be placed into college classes for which she is unprepared.

Many students who presumably have taken more-rigorous writing classes in high school receive no college credit. They are, however, better prepared to succeed at college.

High schools are looking for willing university partners to sanction classes they are already teaching. Colleges are looking to facilitate transfer students; are no longer differentiating between courses taught at accredited colleges and those in a high school.

Other programs like AP (Advanced Placement) make an attempt, however imperfect, to assess student learning using a standard national examination. Colleges feel better about accepting credits when students demonstrate mastery of material on a recognized exam. However, the percentage of high school students able to do well enough on the AP exam to earn college credit is very small.

Most colleges willingly accept credits from like institutions because we trust that our courses are equivalent and that our faculty are credentialed. I doubt that same trust applies to high schools. The best service a high school can provide is to prepare students for college, not substitute for it.

The more we try to expedite learning, the more we send students mixed messages about the distinction between a high school and college education. And we cheapen a college education by making it seem accessible to nearly everyone despite the age and ability of the student or the qualifications of the teacher.

Glenn Sharfman is vice president and dean for academic affairs for Manchester College, in Indiana.

http://www.insidehighered.com/views/2010/12/16/sharfman

In Pursuit of the Perfect Brainstorm

By DAVID SEGAL

Last month, in a small room on the fifth floor of a high-rise building in San Mateo, Calif., three men sat around a table, thinking. The place was wallpapered with Post-it notes, in a riot of colors, plus column after column of index cards pinned to foam boards. Some of the cards had phrases like “space maximizers” or “stuff trackers” written on them. Many had little three-dimensional ink drawings and titles, like “color-coded Tupperware horizontal stacker.” It looked as if these guys had been locked in and told they couldn’t leave until they dreamed up 1,000 of the wackiest home-storage items they could imagine.

Which was pretty much what happened. “We’re in our third month,” said one of the men, Clynton Taylor, “so we’re at about the halfway point.”

This was a project room at Jump Associates, a company with 50 employees that comes up with ideas to solve what it calls “highly ambiguous problems.” Exactly what problem was being solved in the room, and which client asked Jump to solve it, the company wouldn’t say. But Jumpsters, as its employees call themselves, are chattier about closed cases. Procter & Gamble asked Jump to study the future of water and what it portends for a company that makes water-dependent products like soap and laundry detergent. Mars, the candy maker, asked Jump to define the current meaning of “indulgence,” on the theory that it now conjures pampering rather than stuffing your face. General Electric has retained Jump for at least 10 different projects.

Jump’s work has elements of management consulting and a bit of design-firm draftsmanship, but its specialty is conceiving new businesses, and what it sells is really the art of innovation. The company is built on the premise that creative thinking is a kind of expertise. Like P.&G. and Mars, you can hire Jump to think on your behalf, for somewhere between $200,000 to $500,000 a month, depending on the complexity and ambiguity of the question you need answered. Or you can ask Jump to teach your corporation how to generate better ideas on its own; Jump imparts that expertise in one- and five-day how-to-brainstorm training sessions that can cost $200,000 for a one-day session for 25 employees.

This was a pretty exotic business model when Jump opened in 1998, but it isn't today. In the last decade, a quirky legion of idea peddlers has quietly invented what might be a new discipline and is certainly an expanding niche. How and why this happened is, naturally, a subject that everyone in the field theorizes about. What's clear is that in recent years, much of corporate America has gone meta — it has started thinking about thinking. And all that thinking has led many executives to the same conclusion: We need help thinking.

A few idea entrepreneurs, like Jump, Ideo and Kotter International, are companies with offices and payrolls. But many are solo practitioners, brains for hire who lecture at corporations or consult with them regularly. Each has a catechism and a theory about why good ideas can be so hard to come by and what can be done to remedy the situation. Eric Haseltine, who has worked for both Disney and the National Security Agency, draws on the findings of evolutionary psychologists to explain to corporations why they are often unable to see opportunities that are right in front of them. "Although we like to believe we know what is going on in our brains, we know almost nothing about what is going on inside them," he says. "We're not only blind to certain things, but we're blind to the fact that we're blind to them."

Though they offer different messages, idea entrepreneurs have plenty in common. Nearly all are superhigh energy. ("I'm octotasking," said one, speaking on the phone.) Many are just eccentric enough to straddle the line between crank and visionary. (In his spare time, Haseltine is inventing a communication system designed to work in the event of an apocalyptic disaster.) Quite a few of them have published books with the word "innovation" in the title. All of them hate to be called consultants. "I like to position myself as a thought leader," says Vijay Govindarajan, a professor at Dartmouth's Tuck School of Business and co-author of "The Other Side of Innovation." "A consultant solves problems," Govindarajan says. "That is not my role. What I want is for companies to self-diagnose their problems and self-discover their own solutions through my thought leadership."

You often hear this from idea entrepreneurs: Don't ask us for the answers. Let us help you frame the questions, so you can answer them yourself.

When I visited Jump Associates in San Mateo in early November, it was conducting a one-day boot camp, attended by a couple of dozen executives from the region. The morning session started at 8:30 and was led by a handful of Jumpsters, most of whom were in their 30s. Dressed in identical T-shirts, they seemed plucked from the Apple Store. Some of them were M.B.A.'s and former management consultants, but nearly everyone's résumé had a polymathic twist. One Jumpster was a former U.S. forest ranger and Korean foreign-ministry staff member. Another had an undergraduate degree in civil engineering and a master's in visual criticism.

The tone of the day was buoyant and rah-rah in a summer-camp kind of way; it began on a sunlit terrace, where everyone stood in a circle for a few yogalike warm-up exercises, to ease our way to cogitation. Our goal, we soon learned: to conceive business plans that would improve the experience of commercial air travel. (This was a pure, Platonic exercise in innovation, since none of the executives hailed from the airline industry.) For the next few hours, we were schooled in Jump 101, which amounted to a series of interactive lectures, interrupted by small-group sessions in other rooms.

Despite the Up With People tenor, there was serious thought about how ideas are born and nurtured, and why some great ideas die after just a few gulps of oxygen. Like many of its competitors', Jump's core offering is an assortment of refinements to old-fashioned brainstorming. The analogy to weather built into that term is apt, it turns out, because Jump and others contend that without the right atmospheric mix, no brainstorming session will produce the cognitive version of lightning. Dev Patnaik, a sunny, kinetic co-founder and the chief executive of Jump, notes that even under ideal circumstances, traditional brainstorming can devolve into a kind of competitive idea tennis. You think of a new use for pencil. Then me. Then you. Then me. Somehow, the unstated goal is winning, however ill defined victory might seem, instead of ginning up virtuoso concepts.

At Jump, they prefer to brainstorm with a variation of a technique pioneered in improv theater. A comic offers the first sentence of a story, which lurches into a (hopefully funny) tale, when someone else says, “Yes, and?” then adds another sentence, which leads to another “Yes, and?”— and back and forth it goes. In the context of brainstorming, what was once a contest is transformed into a group exercise in storytelling. It has turned into a collaboration.

One of Jump’s first megaclients was Target, in 2001. Still early in its spiffy-design phase, Target was selling home products by the designers Michael Graves and Phillipe Starck. Kmart was teamed up with Martha Stewart. Robyn Waters, then Target’s vice-president of trend, design and product development, was worried that the company’s famous-designer-on-a-budget success was being mimicked in categories that Target considered strongholds. One such category was back-to-college. Using a variety of methods, including “Yes, and?” brainstorming and having anthropologists analyze video footage of collegebound kids shopping for kitchenware, Jump helped devise a product called Kitchen in a Box, a collection of dozens of different utensils, pans, pots and a kettle, later designed by Todd Oldham. Sales took off. “It worked phenomenally well,” Waters says.

Why now? Why did innovation-mania take hold in the last decade or so?

One school of thought holds that corporations both rise and die faster than ever today, placing a premium on the speedy generation of ideas. The dot-com boom accelerated the process, Govindarajan says. “In the late ’90s, people started to say strategy isn’t about stability, it’s about change,” he says.

Other ideas entrepreneurs offer a “great man” theory, pointing to the enormous influence of Clayton M. Christensen, a Harvard Business School professor and an author of books including “The Innovator’s Dilemma”and “Innovation and the General Manager.” Christensen coined the term “disruptive innovation” in 1992 to describe the kind of technological and marketing ideas that blindside established and seemingly well managed businesses. Think of Netflix, which reinvented the way videos are rented and crushed Blockbuster. Or Sears, a titan of retail for decades, which was poleaxed by discounters like Wal-Mart. Christensen has plenty of suggestions for avoiding the fate of the disruptees; for instance, he urges corporations to wall off a division that is built to think creatively and is small enough to be excited by small profits. But all of his prescriptions can be boiled down to three words: Innovate or die.

Dev Patnaik of Jump has his own answer to the why-now question. He contends that advances in technology over the past three decades have gradually forced management to reconceive its role in the corporation, shifting its focus from processing data to something more esoteric. “My dad was a midlevel manager for I.B.M.,” Patnaik explains, “and I remember him in the ’70s, sitting there with plastic 3M transparencies, by hand, with marker, to make presentations. For years, the good manager was one who had data at their fingertips. What’s our sales in Peoria? ‘It’s actually 47 percent above last year.’ People say, ‘Oh, he’s a good manager.’ ” By the early ’90s, though, companies like Microsoft and SAP were selling software that digitized this task. The days when a manager at, say, the Gap could earn a bow just for knowing how many sweaters to ship to Seattle were over. “When that happens, what is the role of the manager?” Patnaik asks. “Suddenly it’s about something else. Suddenly it’s about leadership, creativity, vision. Those are the differentiating things, right?” Patnaik draws an analogy to painting, which for centuries was all about rendering reality as accurately as possible, until a new technology — photography — showed up, throwing all those brush-wielding artists into crisis. “Then painters said: ‘Well, wait, you can tell what *is* but you can’t tell me my *impression* of what is. Here’s how it looks to me, like Seurat. Or the Cubists who said, ‘You can’t capture what is going on from multiple angles.’ ” Technology forced painters to re-evaluate, which transformed their work. Something similar has happened in corporate America. As Patnaik puts it, “We’re in the abstract-expressionist era of management.”

Of course, as expressionistic as this era may be, it is far from an ideal moment to sell innovation. The recession caused many companies to pare back the number of consultants they retain. Meantime, giant

consulting firms like Bain and Booz Allen Hamilton are peering down at this relatively tiny industry with an eye to co-opting it, says Ram Mudambi of Temple University's Fox School of Business. "The traditional consulting firms have talked and advised about innovating for years," he says, "but the advice was usually that it was dangerous for a large company to innovate from within. The mantra was: 'When you want new ideas, buy them. Find a small company and acquire it.' "

Precisely how Jump's business model could work in a management firm with a vastly larger payroll is unclear. "But what Jump and others are doing is squarely in the management-consultants' space," Mudambi says. "So believe me, they're watching."

For the competition part of the day at Jump's boot camp, we were divided into groups of three. Our first job, a Jumpster informed us, was to come up with an idea that would make air travel completely unbearable.

One team thought of a doozy. "A reverse auction," explained Brad Oberwager, the founder of Sundia, which sells premium fruit cups. "Everyone buys a cheap ticket for, say, $200, and then at the gate, an airline employee stands up and says: 'O.K., who wants to get on the plane for $400 more? You can sit anywhere you like.' And so on until all the seats are sold."

A nightmare, everyone agreed. Now, we were told, take that terrible idea and turn it into something that you actually like. After a few minutes of mental jujitsu, the group conjured this: Why not allow, say, a college kid in need of some extra cash to sell his prime window seat to someone willing to part with money to avoid being squished in the middle? If you had the kid's e-mail address, a company, acting as a middleman, could send him or her a message: Would you take $200 to move to 22F?

Airfair was born. After the group spent some time fine-tuning the business model, what was needed, as the deadline for presentations neared, was a catchy motto. People tossed out ideas, one after another.

"How about Airfair: Seat exchange in the air?"

"Exchange your seats in the air."

"Airfair. Your seat choice."

"Airfair: Upgrade in the air"?

"Maybe a play on fair trade."

"Just 'fair trade.' "

"Fair trade in the air?"

This, of course, is the animated and slightly chaotic sound of brainstorming, the term popularized by Alex F. Osborn. In 1948, Osborn, the man who put the O in BBDO, the legendary advertising firm, wrote "Your Creative Power," a jaunty, history-filled book that argued that creativity was essentially a muscle that, with enough exercise, anyone could develop. Especially if that exercise happened in groups, like the ones he started organizing at BBDO in 1939. The key to these sessions, he stated, was creating an atmosphere in which judgment about the quality of any idea is suspended. If participants worry about criticism, they edit themselves, which undermines the process. "The crazier the idea, the better; it's easier to tone down than to think up."

Most idea entrepreneurs offer what could be described as Osborn deluxe. Govindarajan, the Dartmouth professor, presents companies with what he calls the three-box framework. In Box 1, he puts everything a company now does to manage and improve performance. Box 2 is labeled “selectively forgetting the past,” his way of urging clients to avoid fighting competitors and following trends that are no longer relevant. Box 3 is strategic thinking about the future. “Companies spend all of their time in Box 1, and think they are doing strategy,” he says. “But strategy is really about Box 2 and 3 — the challenge to create the future that will exist in 2020.” He recommends to clients what he calls the 30-30 rule: 30 percent of the people who make strategic decisions should be 30 years old or younger. “The executives who’ve been there a long time, they grew up in Box 1,” he says. “You need voices in the room that aren’t vested in the past.”

Eric Haseltine, the entrepreneur who has married management consulting and evolutionary psychology, says he walks his clients through a series of exercises intended to demonstrate how little they know about their brains. One of his favorites is the “cocktail-party phenomenon,” in which he asks participants to eavesdrop on a single conversation in a crowded room. It’s possible only if you manage to ignore every other sound. “Tuning in requires tuning out,” he says, “but few people realize how much they are tuning out at any given moment so they can focus on whatever they are focusing on.” Tuning out is adaptive, he says — it helped our hunter ancestors to focus on their prey and avoid starvation. But his job is to point out to clients how that adaptation can also limit their perspectives without them realizing it, and to offer them practical strategies to deal with these unconscious limitations.

To Patnaik, the traditional groupthink session — even with modifications — misses something crucial about how great ideas are often generated. A lot of breakthroughs are born in meditative states, he says, the mind-set you’re in when alone and driving, for instance. In the past 20 years, he says, neuroscience has found, with the aid of devices like EEGs and fMRIs, a link between the slower rhythms associated with zoning out and creativity. “Why do you have great ideas when you’re in the shower?” Patnaik asks. “You’re at ease. Your sense of judgment is quieted, you’re making nonlinear connections, you’re more likely to come up with great ideas. A shower is basically meditation for amateurs.” They don’t put employees or boot campers in showers at Jump, but they sometimes avoid the sort of directed group thinking that Osborn championed. At a five-day course for G.E. employees, the goal was to come up with a new revenue source for the company’s aircraft-engine division. But Jump didn’t just conduct brainstorming discussions. As the week neared its conclusion, and as the participants started becoming increasingly antsy, Jump sent them shopping. “We sent some to a cooking store, we sent some to a toy store, some to a hardware store,” Patnaik says. “And we told them, ‘We want you to buy something that is a metaphor for the solution.’ ”

One of the participants returned with a model jet, which was sitting on a pedestal that was a black square, painted to look like a small bit of runway. When Patnaik checked in, they were contentedly staring at the model jet and already had a motto for their solution: take the tarmac with you. Private jets, they explained, are generally based in a handful of airports near big cities, but they land in out-of-the-way places that often lack parts and mechanics. Which means the jets are frequently idled, waiting to be fixed. For a subscription fee, G.E. could guarantee jet owners speedy service in, say, 40 different airports. “That didn’t happen from a brainstorming session,” Patnaik says. “If you read Osborn, he tells you to stay focused on the question.” At the final event of the camp I visited, the results of Jump’s techniques were on display. Nine different business pitches for air-travel improvements were presented, each to the entire room. Some were cockamamie (Skyloft, which turns the cargo section of the jet into a gym). Others were goofy (Paciflier, a pacifier that miraculously quiets babies). Every idea was vigorously applauded, but the crowd favorite, in a kind of clap-off that wrapped up the event, was Airfair. By then, the three attendees who imagined it were talking seriously about looking for investors. “I hope you’re not planning to write about this,” one of them told me with surprising gravity, “before we have a chance to run with the idea.”

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http://www.nytimes.com/2010/12/19/magazine/19Industry-t.html?_r=1&ref=magazine

A Physicist Solves the City

By JONAH LEHRER

Photo Illustration by Hubert Blanz

By JONAH LEHRER

Geoffrey West doesn't eat lunch. His doctor says he has a mild allergy to food; meals make him sleepy and nauseated. When West is working — when he's staring at some scribbled equations on scratch paper or gazing out his office window at the high desert in New Mexico — he subsists on black tea and nuts. His gray hair is tousled, and his beard has the longish look of neglect. It's clear that West regards the mundane needs of everyday life — trimming the whiskers, say — as little more than a set of annoying distractions, drawing him away from a much more interesting set of problems. Sometimes West can seem jealous of his computer, this silent machine with no hungers or moods. All it needs is a power cord.

For West, the world is always most compelling at its most abstract. As a theoretical physicist in search of fundamental laws, he likes to compare his work to that of Kepler, Galileo and Newton. "I've always wanted

to find the rules that govern everything," he says. "It's amazing that such rules exist. It's even more amazing that we can find them."

But the 70-year-old West, who grew up in Somerset, England, is no longer trying to solve the physical universe; he's not interested in deep space or string theory. Although West worked for decades as a physicist at Stanford University and Los Alamos National Laboratory, he started thinking about leaving the field after the financing for the Texas superconducting supercollider was canceled by Congress in 1993. West, however, wasn't ready to retire, and so he began searching for subjects that needed his skill set.

Eventually he settled on cities: the urban jungle looked chaotic — all those taxi horns and traffic jams — but perhaps it might be found to obey a short list of universal rules. "We spend all this time thinking about cities in terms of their local details, their restaurants and museums and weather," West says. "I had this hunch that there was something more, that every city was also shaped by a set of hidden laws."

And so West set out to solve the City. As he points out, this is an intellectual problem with immense practical implications. Urban population growth is the great theme of modern life, one that's unfolding all across the world, from the factory boomtowns of Southern China to the sprawling *favelas* of Rio de Janeiro. As a result, for the first time in history, the majority of human beings live in urban areas. (The numbers of city dwellers are far higher in developed countries — the United States, for instance, is 82 percent urbanized.) Furthermore, the pace of urbanization is accelerating as people all over the world flee the countryside and flock to the crowded street.

This relentless urban growth has led to a renewed interest in cities in academia and in government. In February 2009, President Obama established the first White House Office of Urban Affairs, which has been told to develop a "policy agenda for urban America." Meanwhile, new perspectives have come to the field of urban studies. Macroeconomists, for instance, have focused on the role of cities in driving gross domestic product and improving living standards, while psychologists have investigated the impact of city life on self-control and short-term memory. Even architects are moving into the area: Rem Koolhaas, for one, has argued that architects have become so obsessed with pretty buildings that they've neglected the vital spaces between them.

But West wasn't satisfied with any of these approaches. He didn't want to be constrained by the old methods of social science, and he had little patience for the unconstrained speculations of architects. (West considers urban theory to be a field without principles, comparing it to physics before Kepler pioneered the laws of planetary motion in the 17th century.) Instead, West wanted to begin with a blank page, to study cities as if they had never been studied before. He was tired of urban theory — he wanted to invent urban science.

For West, this first meant trying to gather as much urban data as possible. Along with Luis Bettencourt, another theoretical physicist who had abandoned conventional physics, and a team of disparate researchers, West began scouring libraries and government Web sites for relevant statistics. The scientists downloaded huge files from the Census Bureau, learned about the intricacies of German infrastructure and bought a thick and expensive almanac featuring the provincial cities of China. (Unfortunately, the book was in Mandarin.) They looked at a dizzying array of variables, from the total amount of electrical wire in Frankfurt to the number of college graduates in Boise. They amassed stats on gas stations and personal income, flu outbreaks and homicides, coffee shops and the walking speed of pedestrians.

After two years of analysis, West and Bettencourt discovered that all of these urban variables could be described by a few exquisitely simple equations. For example, if they know the population of a metropolitan area in a given country, they can estimate, with approximately 85 percent accuracy, its average income and the dimensions of its sewer system. These are the laws, they say, that automatically emerge whenever people "agglomerate," cramming themselves into apartment buildings and subway cars. It doesn't matter if the place is Manhattan or Manhattan, Kan.: the urban patterns remain the same. West isn't shy about describing the

magnitude of this accomplishment. “What we found are the constants that describe every city,” he says. “I can take these laws and make precise predictions about the number of violent crimes and the surface area of roads in a city in Japan with 200,000 people. I don’t know anything about this city or even where it is or its history, but I can tell you all about it. And the reason I can do that is because every city is really the same.” After a pause, as if reflecting on his hyperbole, West adds: “Look, we all know that every city is unique. That’s all we talk about when we talk about cities, those things that make New York different from L.A., or Tokyo different from Albuquerque. But focusing on those differences misses the point. Sure, there are differences, but different from what? We’ve found the what.”

There is something deeply strange about thinking of the metropolis in such abstract terms. We usually describe cities, after all, as local entities defined by geography and history. New Orleans isn’t a generic place of 336,644 people. It’s the bayou and Katrina and Cajun cuisine. New York isn’t just another city. It’s a former Dutch fur-trading settlement, the center of the finance industry and home to the Yankees. And yet, West insists, those facts are mere details, interesting anecdotes that don’t explain very much. The only way to really understand the city, West says, is to understand its deep structure, its defining patterns, which will show us whether a metropolis will flourish or fall apart. We can’t make our cities work better until we know how they work. And, West says, he knows how they work.

West has been drawn to different fields before. In 1997, less than five years after he transitioned away from high-energy physics, he published one of the most contentious and influential papers in modern biology. (The research, which appeared in Science, has been cited more than 1,500 times.) The last line of the paper summarizes the sweep of its ambition, as West and his co-authors assert that they have just solved “the single most pervasive theme underlying all biological diversity,” showing how the most vital facts about animals — heart rate, size, caloric needs — are interrelated in unexpected ways.

The mathematical equations that West and his colleagues devised were inspired by the earlier findings of Max Kleiber. In the early 1930s, when Kleiber was a biologist working in the animal-husbandry department at the University of California, Davis, he noticed that the sprawlingly diverse animal kingdom could be characterized by a simple mathematical relationship, in which the metabolic rate of a creature is equal to its mass taken to the three-fourths power. This ubiquitous principle had some significant implications, because it showed that larger species need less energy per pound of flesh than smaller ones. For instance, while an elephant is 10,000 times the size of a guinea pig, it needs only 1,000 times as much energy. Other scientists soon found more than 70 such related laws, defined by what are known as “sublinear” equations. It doesn’t matter what the animal looks like or where it lives or how it evolved — the math almost always works.

West’s insight was that these strange patterns are caused by our internal infrastructure — the plumbing that makes life possible. By translating these biological designs into mathematics, West and his co-authors were able to explain the existence of Kleiber’s scaling laws. “I can’t tell you how satisfying this was,” West says. “Sometimes, I look out at nature and I think, Everything here is obeying my conjecture. It’s a wonderfully narcissistic feeling.”

Not every biologist was persuaded, however. In fact, West’s paper in Science ignited a flurry of rebuttals, in which researchers pointed out all the species that violated the math. West can barely hide his impatience with what he regards as quibbles. “There are always going to be people who say, ‘What about the crayfish?’ ” he says. “Well, what about it? Every fundamental law has exceptions. But you still need the law or else all you have is observations that don’t make sense. And that’s not science. That’s just taking notes.” For West, arguments over the details of crustaceans were a sure sign that it was time to move on. And so, in 2002, he began to think seriously about cities.

The correspondence was obvious to West: he saw the metropolis as a sprawling organism, similarly defined by its infrastructure. (The boulevard was like a blood vessel, the back alley a capillary.) This implied that the real purpose of cities, and the reason cities keep on growing, is their ability to create massive economies of

scale, just as big animals do. After analyzing the first sets of city data — the physicists began with infrastructure and consumption statistics — they concluded that cities looked a lot like elephants. In city after city, the indicators of urban "metabolism," like the number of gas stations or the total surface area of roads, showed that when a city doubles in size, it requires an increase in resources of only 85 percent.

This straightforward observation has some surprising implications. It suggests, for instance, that modern cities are the real centers of sustainability. According to the data, people who live in densely populated places require less heat in the winter and need fewer miles of asphalt per capita. (A recent analysis by economists at Harvard and U.C.L.A. demonstrated that the average Manhattanite emits 14,127 fewer pounds of carbon dioxide annually than someone living in the New York suburbs.) Small communities might look green, but they consume a disproportionate amount of everything. As a result, West argues, creating a more sustainable society will require our big cities to get even bigger. We need more megalopolises.

But a city is not just a frugal elephant; biological equations can't entirely explain the growth of urban areas. While the first settlements in Mesopotamia might have helped people conserve scarce resources — irrigation networks meant more water for everyone — the concept of the city spread for an entirely different reason. "In retrospect, I was quite stupid," West says. He was so excited by the parallels between cities and living things that he "didn't pay enough attention to the ways in which urban areas and organisms are completely different."

What Bettencourt and West failed to appreciate, at least at first, was that the value of modern cities has little to do with energy efficiency. As West puts it, "Nobody moves to New York to save money on their gas bill." Why, then, do we put up with the indignities of the city? Why do we accept the failing schools and overpriced apartments, the bedbugs and the traffic?

In essence, they arrive at the sensible conclusion that cities are valuable because they facilitate human interactions, as people crammed into a few square miles exchange ideas and start collaborations. "If you ask people why they move to the city, they always give the same reasons," West says. "They've come to get a job or follow their friends or to be at the center of a scene. That's why we pay the high rent. Cities are all about the people, not the infrastructure."

It's when West switches the conversation from infrastructure to people that he brings up the work of Jane Jacobs, the urban activist and author of "The Death and Life of Great American Cities." Jacobs was a fierce advocate for the preservation of small-scale neighborhoods, like Greenwich Village and the North End in Boston. The value of such urban areas, she said, is that they facilitate the free flow of information between city dwellers. To illustrate her point, Jacobs described her local stretch of Hudson Street in the Village. She compared the crowded sidewalk to a spontaneous "ballet," filled with people from different walks of life. School kids on the stoops, gossiping homemakers, "business lunchers" on their way back to the office. While urban planners had long derided such neighborhoods for their inefficiencies — that's why Robert Moses, the "master builder" of New York, wanted to build an eight-lane elevated highway through SoHo and the Village — Jacobs insisted that these casual exchanges were essential. She saw the city not as a mass of buildings but rather as a vessel of empty spaces, in which people interacted with other people. The city wasn't a skyline — it was a dance.

If West's basic idea was familiar, however, the evidence he provided for it was anything but. The challenge for Bettencourt and West was finding a way to quantify urban interactions. As usual, they began with reams of statistics. The first data set they analyzed was on the economic productivity of American cities, and it quickly became clear that their working hypothesis — like elephants, cities become more efficient as they get bigger — was profoundly incomplete. According to the data, whenever a city doubles in size, every measure of economic activity, from construction spending to the amount of bank deposits, *increases* by approximately 15 percent per capita. It doesn't matter how big the city is; the law remains the same. "This remarkable equation is why people move to the big city," West says. "Because you can take the same person, and if you

just move them to a city that's twice as big, then all of a sudden they'll do 15 percent more of everything that we can measure." While Jacobs could only speculate on the value of our urban interactions, West insists that he has found a way to "scientifically confirm" her conjectures. "One of my favorite compliments is when people come up to me and say, 'You have done what Jane Jacobs would have done, if only she could do mathematics,' " West says. "What the data clearly shows, and what she was clever enough to anticipate, is that when people come together, they become much more productive."

West illustrates the same concept by describing the Santa Fe Institute, an interdisciplinary research organization, where he and Bettencourt work. The institute itself is a sprawl of common areas, old couches and tiny offices; the coffee room is always the most crowded place. "S.F.I. is all about the chance encounters," West says. "There are few planned meetings, just lots of unplanned conversations. It's like a little city that way." The previous evening, West and I ran into the novelist Cormac McCarthy at the institute, where McCarthy often works. The physicist and the novelist ended up talking about Antarctic icefish, the editing process and convergent evolution for 45 minutes. Of course, these interpersonal collisions — the human friction of a crowded space — can also feel unpleasant. We don't always want to talk with strangers on the subway or jostle with people on the sidewalk. West admits that all successful cities are a little uncomfortable. He describes the purpose of urban planning as finding a way to minimize our distress while maximizing our interactions. The residents of Hudson Street, after all, didn't seem to mind mingling with one another on the sidewalk. As Jacobs pointed out, the layout of her Manhattan neighborhood — the short blocks, the mixed-use zoning, the density of brownstones — made it easier to cope with the strain of the metropolis. It's fitting that it's called the Village.

In recent decades, though, many of the fastest-growing cities in America, like Phoenix and Riverside, Calif., have given us a very different urban model. These places have traded away public spaces for affordable single-family homes, attracting working-class families who want their own white picket fences. West and Bettencourt point out, however, that cheap suburban comforts are associated with poor performance on a variety of urban metrics. Phoenix, for instance, has been characterized by below-average levels of income and innovation (as measured by the production of patents) for the last 40 years. "When you look at some of these fast-growing cities, they look like tumors on the landscape," West says, with typical bombast. "They have these extreme levels of growth, but it's not sustainable growth." According to the physicists, the trade-off is inevitable. The same sidewalks that lead to "knowledge trading" also lead to cockroaches.

Consider the data: When Bettencourt and West analyzed the negative variables of urban life, like crime and disease, they discovered that the exact same mathematical equation applied. After a city doubles in size, it also experiences a 15 percent per capita increase in violent crimes, traffic and AIDS cases. (Of course, these trends are only true in general. Some cities can bend the equations with additional cops or strict pollution regulations.) "What this tells you is that you can't get the economic growth without a parallel growth in the spread of things we don't want," Bettencourt says. "When you double the population, everything that's related to the social network goes up by the same percentage."

West and Bettencourt refer to this phenomenon as "superlinear scaling," which is a fancy way of describing the increased output of people living in big cities. When a superlinear equation is graphed, it looks like the start of a roller coaster, climbing into the sky. The steep slope emerges from the positive feedback loop of urban life — a growing city makes everyone in that city more productive, which encourages more people to move to the city, and so on. According to West, these superlinear patterns demonstrate why cities are one of the single most important inventions in human history. They are the idea, he says, that enabled our economic potential and unleashed our ingenuity. "When we started living in cities, we did something that had never happened before in the history of life," West says. "We broke away from the equations of biology, all of which are sublinear. Every other creature gets slower as it gets bigger. That's why the elephant plods along. But in cities, the opposite happens. As cities get bigger, everything starts accelerating. There is no equivalent for this in nature. It would be like finding an elephant that's proportionally faster than a mouse."

There is, of course, a very good reason that animals slow down with size: All that mass requires energy. Because the elephant has to eat so much to feed itself, it can't afford to run around like a little rodent. But the superlinear growth of cities comes with no such inherent constraints. Instead, the urban equations predict a world of ever-increasing resource consumption, as the expansion of cities fuels the expansion of economies. In fact, the societal consumption driven by the process of urbanization — our collective desire for iPads, Frappuccinos and the latest fashions — more than outweighs the ecological benefits of local mass transit.

West illustrates the problem by translating human life into watts. "A human being at rest runs on 90 watts," he says. "That's how much power you need just to lie down. And if you're a hunter-gatherer and you live in the Amazon, you'll need about 250 watts. That's how much energy it takes to run about and find food. So how much energy does our lifestyle [in America] require? Well, when you add up all our calories and then you add up the energy needed to run the computer and the air-conditioner, you get an incredibly large number, somewhere around 11,000 watts. Now you can ask yourself: What kind of animal requires 11,000 watts to live? And what you find is that we have created a lifestyle where we need more watts than a blue whale. We require more energy than the biggest animal that has ever existed. That is why our lifestyle is unsustainable. We can't have seven billion blue whales on this planet. It's not even clear that we can afford to have 300 million blue whales."

The historian Lewis Mumford described the rise of the megalopolis as "the last stage in the classical cycle of civilization," which would end with "complete disruption and downfall." In his more pessimistic moods, West seems to agree: he knows that nothing can trend upward forever. In fact, West sees human history as defined by this constant tension between expansion and scarcity, between the relentless growth made possible by cities and the limited resources that hold our growth back. "The only thing that stops the superlinear equations is when we run out of something we need," West says. "And so the growth slows down. If nothing else changes, the system will eventually start to collapse."

How do we avoid this bleak fate? Constant innovation. After a resource is exhausted, we are forced to exploit a new resource, if only to sustain our superlinear growth. West cites a long list of breakthroughs to illustrate this historical pattern, from the discovery of the steam engine to the invention of the Internet. "These major innovations completely changed the way society operates," West says. "It's like we're on the edge of a cliff, about to run out of something, and then we find a new way of creating wealth. That means we can start to climb again."

But the escape is only temporary, as every innovation eventually leads to new shortages. We clear-cut forests, and so we turn to oil; once we exhaust our fossil-fuel reserves, we'll start driving electric cars, at least until we run out of lithium. This helps explain why West describes cities as the only solution to the problem of cities. Although urbanization has generated a seemingly impossible amount of economic growth, it has also inspired the innovations that allow the growth to continue.

There is a serious complication to this triumphant narrative of cliff edges and creativity, however. Because our lifestyle has become so expensive to maintain, every new resource now becomes exhausted at a faster rate. This means that the cycle of innovations has to constantly accelerate, with each breakthrough providing a shorter reprieve. The end result is that cities aren't just increasing the pace of life; they are also increasing the pace at which life changes. "It's like being on a treadmill that keeps on getting faster," West says. "We used to get a big revolution every few thousand years. And then it took us a century to go from the steam engine to the internal-combustion engine. Now we're down to about 15 years between big innovations. What this means is that, for the first time ever, people are living through multiple revolutions. And this all comes from cities. Once we started to urbanize, we put ourselves on this treadmill. We traded away stability for growth. And growth requires change."

While listening to West talk about cities, it's easy to forget that his confident pronouncements are mere correlations, and that his statistics can only hint at possible explanations. Not surprisingly, many urban

theorists disagree with West's conclusions. Some resent the implication that future urban research should revolve around a few abstract mathematical laws. Other theorists, like Joel Kotkin, a fellow in urban futures at Chapman University, in Orange, Calif., argue that the working model of Bettencourt and West is already obsolete and fails to explain recent trends. "In the last decade, suburbs have produced six times as many jobs," Kotkin says. And these aren't just unskilled service jobs. Kotkin says the centers of American innovation are now low-density metropolitan areas like Silicon Valley and Raleigh-Durham, N.C. "For a supposedly complete theory" of cities, Kotkin says, "this work fails to explain a lot of what's happening right now."

The theoretical physicists aren't discouraged by these critiques. While they admit their equations are imperfect, they insist the work remains a necessary first draft. "When Kepler found the laws that govern planetary motion, he didn't get the laws exactly right," West says. "But the laws were still good enough to inspire Newton." In the meantime, West and Bettencourt continue to search for new statistics (they have just received a data set from the I.R.S.) that they hope to feed back into the model. Nevertheless, West says they believe that their essential theory — those superlinear and sublinear laws — will remain intact. The math is scientifically sound.

In fact, West is so satisfied with his urban research that he's already becoming a little restless. Recently, he and Bettencourt, led by this impatience, began exploring yet another subject: the corporation. At first glance, cities and companies look very similar. They're both large agglomerations of people, interacting in a well-defined physical space. They contain infrastructure and human capital; the mayor is like a C.E.O.

But it turns out that cities and companies differ in a very fundamental regard: cities almost never die, while companies are extremely ephemeral. As West notes, Hurricane Katrina couldn't wipe out New Orleans, and a nuclear bomb did not erase Hiroshima from the map. In contrast, where are Pan Am and Enron today? The modern corporation has an average life span of 40 to 50 years.

This raises the obvious question: Why are corporations so fleeting? After buying data on more than 23,000 publicly traded companies, Bettencourt and West discovered that corporate productivity, unlike urban productivity, was entirely sublinear. As the number of employees grows, the amount of profit per employee shrinks. West gets giddy when he shows me the linear regression charts. "Look at this bloody plot," he says. "It's ridiculous how well the points line up." The graph reflects the bleak reality of corporate growth, in which efficiencies of scale are almost always outweighed by the burdens of bureaucracy. "When a company starts out, it's all about the new idea," West says. "And then, if the company gets lucky, the idea takes off. Everybody is happy and rich. But then management starts worrying about the bottom line, and so all these people are hired to keep track of the paper clips. This is the beginning of the end."

The danger, West says, is that the inevitable decline in profit per employee makes large companies increasingly vulnerable to market volatility. Since the company now has to support an expensive staff — overhead costs increase with size — even a minor disturbance can lead to significant losses. As West puts it, "Companies are killed by their need to keep on getting bigger."

For West, the impermanence of the corporation illuminates the real strength of the metropolis. Unlike companies, which are managed in a top-down fashion by a team of highly paid executives, cities are unruly places, largely immune to the desires of politicians and planners. "Think about how powerless a mayor is," West says. "They can't tell people where to live or what to do or who to talk to. Cities can't be managed, and that's what keeps them so vibrant. They're just these insane masses of people, bumping into each other and maybe sharing an idea or two. It's the freedom of the city that keeps it alive."

Jonah Lehrer is the author, most recently, of "How We Decide."

http://www.nytimes.com/2010/12/19/magazine/19Urban_West-t.html?ref=magazine

The Incredible Flying Nonagenarian

By BRUCE GRIERSON

Patrik Giardino for The New York Times

Olga Kotelko's long jump record is 5.8 feet. (**High-School Record, Women's:** 22.3 ft.; **World Record, Women's:** 24.8 ft.)

By BRUCE GRIERSON

On the third floor of the Montreal Chest Institute, at McGill University, Olga Kotelko stood before a treadmill in the center of a stuffy room that was filling up with people who had come just for her. They were there to run physical tests, or to extract blood from her earlobe, or just to observe and take notes. Kotelko removed her glasses. She wore white New Balance sneakers and black running tights, and over her silver hair, a plastic crown that held in place a breathing tube.

Tanja Taivassalo, a 40-year-old muscle physiologist, adjusted the fit of Kotelko's stretch-vest. It was wired with electrodes to measure changes in cardiac output — a gauge of the power of her heart. Taivassalo first met Kotelko at last year's world outdoor masters track championships in Lahti, Finland, the pinnacle of the competitive season for older tracksters. Taivassalo went to watch her dad compete in the marathon. But she could hardly fail to notice the 91-year-old Canadian, bespandexed and elfin, who was knocking off world record after world record.

Masters competitions usually begin at 35 years, and include many in their 60s, 70s and 80s (and a few, like Kotelko, in their 90s, and one or two over 100). Of the thousands who descended on Lahti, hundreds were

older than 75. And the one getting all the attention was Kotelko. She is considered one of the world's greatest athletes, holding 23 world records, 17 in her current age category, 90 to 95.

"We have in masters track 'hard' records and 'soft' records," says Ken Stone, editor of masterstrack.com — the main news source of the growing masters athletic circuit. "Soft records are like low-hanging fruit," where there are so few competitors, you're immortalized just for showing up. But Stone doesn't consider Kotelko's records soft, because her performances are remarkable in their own right. At last fall's Lahti championship, Kotelko threw a javelin more than 20 feet farther than her nearest age-group rival. At the World Masters Games in Sydney, Kotelko's time in the 100 meters — 23.95 seconds — was faster than that of some finalists in the 80-to-84-year category, two brackets down. World Masters Athletics, the governing body of masters track, uses "age-graded" tables developed by statisticians to create a kind of standard score, expressed as a percentage, for any athletic feat. The world record for any given event would theoretically be assigned 100 percent. But a number of Kotelko's marks — in shot put, high jump, 100-meter dash — top 100 percent. (Because there are so few competitors over 90, age-graded scores are still guesswork.)

In Lahti, watching Kotelko run fast enough that the wind blew her hair back a bit, Taivassalo was awed on a personal level (she's a runner) and tantalized on a professional one. She hoped to start a database of athletes over 85, testing various physiological parameters.

Scientifically, this is mostly virgin ground. The cohort of people 85 and older — the fastest-growing segment of the population, as it happens — is increasingly being studied for longevity clues. But so far the focus has mostly been on their lives: the foods they eat, the air they breathe, the social networks they maintain and, in a few recently published studies, their genomes. Data on the long-term effects of exercise is only just starting to trickle in, as the children of the fitness revolution of the '70s grow old.

Though the world of masters track offers a compelling research pool, Taivassalo may seem like an unlikely scientist to be involved. Her area of expertise is mitochondrial research; she examines what happens to the body when mitochondria, the cell's power plants, are faulty. Her subjects are typically young people who come into the lab with neuromuscular disorders that are only going to get worse. (Because muscle cells require so much energy, they're hit hard when mitochondria go down.) Some researchers now see aging itself as a kind of mitochondrial disease. Defective mitochondria appear as we get older, and these researchers say that they rob us of endurance, strength and function. There's evidence that for young patients with mitochondrial disease, exercise is a potent tool, slowing the symptoms. If that's true, then exercise could also potentially be a kind of elixir of youth, combating the ravages of aging far more than we thought.

You don't have to be an athlete to notice how ruthlessly age hunts and how programmed the toll seems to be. We start losing wind in our 40s and muscle tone in our 50s. Things go downhill slowly until around age 75, when something alarming tends to happen.

"There's a slide I show in my physical-activity-and-aging class," Taivassalo says. "You see a shirtless fellow holding barbells, but I cover his face. I ask the students how old they think he is. I mean, he could be 25. He's just ripped. Turns out he's 67. And then in the next slide there's the same man at 78, in the same pose. It's very clear he's lost almost half of his muscle mass, even though he's continued to work out. So there's something going on." But no one knows exactly what. Muscle fibers ought in theory to keep responding to training. But they don't. Something is applying the brakes.

And then there is Olga Kotelko, who further complicates the picture, but in a scientifically productive way. She seems not to be aging all that quickly. "Given her rather impressive retention of muscle mass," says Russ Hepple, a University of Calgary physiologist and an expert in aging muscle, "one would guess that she has some kind of resistance." In investigating that resistance, the researchers are hoping to better understand how to stall the natural processes of aging.

Hepple, who is 44 and still built like the competitive runner he used to be, met Taivassalo at an exercise-physiology conference. She did her Ph.D. on people with mitochondrial disease; he was better acquainted with rats. They married. In the room at McGill, Hepple leaned in to the treadmill, barking encouragement to Kotelko as needed as she jacked her heart rate up beyond 135. In the end, Kotelko's "maxVO2" score — a strong correlate of cardiovascular endurance — topped out at 15.5. That's about what you'd expect from a "trained athlete of 91," if such a type existed.

In truth, there is no type. Though when you hear the stories of older senior athletes, a common thread does emerge. While most younger masters athletes were jocks in college if not before, many competitors in the higher brackets — say, older than age 70 — have come to the game late. They weren't athletes earlier in life because of the demands of career and their own growing families. Only after their duties cleared could they tend that other fire.

That's Kotelko's story, too. She grew up, with parents of Ukrainian descent, on a farm in Vonda, Saskatchewan, No. 7 of 11 kids. In the morning, after the chickens were fed and the pigs slopped and the cows milked, the brood would trudge two miles to school, stuff a broken old softball with sand or rags and play ball. Kotelko loved the game and played through childhood, but as she got older, the opportunities just weren't there.

As an adult she taught grades 1 through 10 in the one-room schoolhouse in Vonda, married the wrong man young and, realizing her mistake, fled for British Columbia in 1957 with two daughters and brought them up alone, earning her bachelor's degree at night. Much of her adulthood had run through her fingers before she could even think again about sports.

She picked up softball again after retiring from teaching in 1984 — slow-pitch, but pretty competitive. ("We went for blood.") And then one day when she was 77, a teammate suggested she might enjoy track and field.

She hooked up with a local coach, who taught her the basics. She found a trainer — a strict Hungarian woman who seemed as eager to push her as Kotelko was keen to be pushed. Juiced with enthusiasm, Kotelko hit the gym hard, three days a week in season. For up to three hours at a stretch, she performed punishing exercises like planks and roman chairs and bench presses and squats, until her muscles quivered and gassed out.

Though she still does some of these things — the push-ups (three sets of 10), the situps (three sets of 25) — she doesn't push herself the same way anymore. Apart from Aquafit classes three times a week, she pretty much takes the whole dreary Vancouver winter off. Then, come spring, four weeks or so before the first competition of the season (she'll usually enter five or six meets each year), she starts her routine. She carts her gear to the track at the high school. She dons her spikes, takes a spade and turns the middens of teenage recreation into long-jump pits. And then goes to it — alone. On the track she will often run intervals: slow for a minute, then full out for a minute. At the beginning of each year she figures out where to put her energy. This year it'll be throws and jumps and the 100-meter dash — the only meaningful world record missing from her résumé. She says she may not run the 200 and 400 again until 2014, when she moves up into the 95-plus age category. (Her current world marks in those events, she reckons, will be safe for four more years.)

She does deep breathing and reflexology. She has developed a massage program, which she rolls out most nights, called the "O.K." routine, after her own initials. It involves systematically kneading her whole body, from stem to gudgeon, while lying in bed. Sometimes she'll work one part of her body while stretching another with a looped strap. ("I don't like wasting time," she says.)

Ken Stone calls her "bulletproof," and her history even off the track bears the label out. Apart from two visits to give birth to her daughters, she has seen the inside of a hospital once in her life, for a hysterectomy.

Kotelko acknowledged her good luck as she put away a big plate of pasta and a glass of red wine one evening, midway through the world indoor championships in Kamloops, British Columbia, this spring.

“How old do you feel?” I asked her.

“Well, I still have the energy I had at 50,” she said. “More. Where is it coming from? Honestly, I don’t know. It’s a mystery even to me.”

The previous day, on a patch of grass tricked out as a javelin field, I watched Kotelko come forward for her turn to throw. Kotelko, who is five feet tall, took the javelin offered by an official with quiet dispatch, like a hockey player accepting a new stick from the bench. There was a bit of a crosswind; it didn’t affect her too much. She picked a cloud to aim at (a tip she first read about in a library book). Ritualistically, she touched the spear tip, rocked on the back foot and let fly, all momentum. It traveled 41 feet.

Later, in her favorite event, the hammer throw, Kotelko took her place on the pitch with the other competitors — younger women she competes alongside, though not strictly against, since at this meet she was the only woman in the 90-and-over category. She removed her glasses. She swung the seven-pound cannonball around her head — once, twice, three times — and the thing sailed, landing with a thud, 45.5 feet away. “If I spun I could throw it farther,” she admitted later, but after watching somebody very old fall that way, she has decided not to risk it.

EXERCISE HAS BEEN shown to add between six and seven years to a life span (and improve the quality of life in countless ways). Any doctor who didn’t recommend exercise would be immediately suspect. But for most seniors, that prescription is likely to be something like a daily walk or Aquafit. It’s not quarter-mile timed intervals or lung-busting fartleks. There’s more than a little suffering in the difference.

Here, though, is the radical proposition that’s starting to gain currency among researchers studying masters athletes: what if intense training does something that allows the body to regenerate itself? Two recent studies involving middle-aged runners suggest that the serious mileage they were putting in, over years and years, had protected them at the chromosomal level. It appears that exercise may stimulate the production of telomerase, an enzyme that maintains and repairs the little caps on the ends of chromosomes that keep genetic information intact when cells divide. That may explain why older athletes aren’t just more cardiovascularly fit than their sedentary counterparts — they are more free of age-related illness in general.

Exactly how exercise affects older people is complicated. On one level, exercise is a flat-out insult to the body. Downhill running tears quadriceps muscles as reliably as an injection of snake venom. All kinds of free radicals and other toxins are let loose. But the damage also triggers the production of antioxidants that boost the health of the body generally. So when you see a track athlete who looks as if that last 1,500-meter race damn near killed him, you’re right. It might have made him stronger in the deal.

Exercise training helps stop muscle strength and endurance from slipping away. But it seems to also do something else, maintains Mark Tarnopolsky, a professor of pediatrics and medicine at McMaster University in Hamilton, Ontario (who also happens to be a top-ranked trail runner). Resistance exercise in particular seems to activate a muscle stem cell called a satellite cell. With the infusion of these squeaky-clean cells into the system, the mitochondria seem to rejuvenate. (The phenomenon has been called “gene shifting.”) If Tarnopolsky is right, exercise in older adults can roll back the odometer. After six months of twice weekly strength exercise training, he has shown, the biochemical, physiological and genetic signature of older muscle is “turned back” nearly 15 or 20 years.

Whether we are doing really old folks any favors by prescribing commando-grade training, well, “that’s the million-dollar question,” Hepple says. “Olga can obviously handle it. But most people aren’t Olga.” In

general, kidneys and other organs tend to have trouble managing the enzymes and byproducts produced when muscle breaks down. Inflammation, which produces that good kind of soreness weekend warriors are familiar with, “also damages a lot of healthy tissue around it,” notes Li Li Ji, an exercise physiologist at the University of Wisconsin, Madison. “That’s why I usually discourage older people from being too ambitious.”

Yet if there’s a single trend in the research into exercise and gerontology, it’s that we have underestimated what old folks are capable of, from how high their heart rates can safely climb to how deeply into old age they can exercise with no major health risks.

The conundrum for masters athletes — though it seems Kotelko’s great fortune to have largely escaped the phenomenon — is this: Big physiological benefits from exercise are there for the taking. You just have to keep exercising. But you can’t exercise if the body breaks down. To avoid injuries, aging track athletes are often advised to keep to their old routines but to lower the intensity. The best advertisement for that strategy was a race turned in five years ago by a 73-year-old from Ontario. Age-graded, Ed Whitlock’s 2:54 marathon (the equivalent of a 20-year-old running 2:03.57) was the fastest ever run. When people collared him afterward to find out his training secret, they learned that he ran every day, slowly, for hours, around the local cemetery.

Kotelko herself speaks often of the perils of getting carried away. “If you undertrain, you might not finish,” she says. “If you overtrain, you might not start.” But there’s some evidence that, in trying to find the sweet spot between staying in race shape and avoiding the medical tent, a lot of seniors athletes aren’t training hard enough — or at least, aren’t training the right way to maximally exploit what their body can still do.

Recently, Scott Trappe, director of the Human Performance Laboratory at Ball State University in Muncie, Ind., published a study on weightlessness and exercise in The Journal of Applied Physiology. Using M.R.I. and biopsy data from NASA, he looked at the exercise program of nine astronauts from the International Space Station. In many ways, an astronaut in zero gravity is undergoing an experiment in accelerated aging — muscles atrophy, bone-density declines. That’s what these astronauts were finding too, even though they were using a treadmill, a stationary bike and a resistance machine.

Trappe concluded the regime wasn’t nearly hard-core enough. His prescription for NASA: heavier loads and explosive movements. “It’s pretty clear that intensity wins up there,” he says. “And I would predict this to be the case as we age. Part of the challenge is the mind-set or dogma that we need to slow down as we get older.” For example, the belief that aging joints and tendons can’t take real weight-training is dead wrong; real weight-training is what might just save them. Seniors can work out less frequently, Trappe reckons, as long as they really bring it when they do.

Kotelko used to train like that — spurred on by her severe Hungarian coach. Strangely though, since easing off the throttle the last few years, she’s getting some of the best results of her life. It’s hard to know what to conclude from that, except perhaps that the gene-shifting theory is true, and Kotelko is still enjoying the compound interest from that earlier sweat equity. “What I do now seems adequate,” she reasons. “It must be. I keep getting world records.”

THE DAY AFTER the treadmill test, Kotelko was ushered into the free-weight gym at McGill University. She lay down at the bench press. Taivassalo was interested in the composition of Kotelko’s muscle fibers. We all have Type 1 muscle (slow-twitch, for endurance) and a couple of varieties of Type 2 (fast-twitch, used for power). Most people are born with roughly half of Type 1 and half of Type 2. Around age 70, fast-twitch muscle begins to stop responding, followed by the decline of slow-twitch a decade later. Power drains away. Trappe calls this the “fast-twitch-fiber problem.” It helps explain the frustration that aging sprinters feel when their times drop off despite their dogged efforts. And no matter how high-tech their exercise program, how strong their will, how good their genes, nobody escapes. Often, the drop-off happens too gradually to notice. But sometimes little moments of perspective pop up.

In Kamloops, Kotelko jumped 5.5 feet to trump her own indoor long-jump world record. Afterward, the sexagenarian pentathletes took to the pit. Among them was Philippa (Phil) Raschker, a 63-year-old from Marietta, Ga., legendary on the masters track circuit. Raschker holds, or has held, more than 200 national and world records — sprints, jumps, hurdles. She was competing in nine events in Kamloops. (This despite being pretty much exhausted from working late into the night filing clients' taxes for days on end. She's an accountant; it was March.) When I first saw her high jumping, from a distance, I thought she could have been 25. You could see, below her stretch top, the six-pack. But it wasn't how Raschker looked that arrested; it was the way she moved. Raschker Fosbury-flopped over the bar like water pouring from a jug. The flop allows you to jump higher than other methods do because your center of gravity never actually clears the bar. But the severe back arch demands a suppleness that's alien to the aging body, which is why pretty much no one over 65 does it. Kotelko was already too old to flop when she took up track at age 77. Instead, she sort of bestrides the bar. Her world record of 2.7 feet is just a little higher than the superfoamy mat. Overall, Kotelko's high jump gives the impression of someone taking a run at a hotel-room bed.

The difference between the world's greatest 60-year-old and the world's greatest 90-year-old was clear. On view was the march of "sarcopenia" — the loss of muscle, the theft of that once-explosive power that makes the very old seem subject to a different set of physical laws.

It is irresistible to think of Olga Kotelko and Phil Raschker as twins separated by time. Except that Raschker has the potential advantage of a much earlier head start on the track. Given all that extra compounding interest, might she in 30 years become a kind of super-Olga?

"Hard to say," Hepple says. "She's obviously at a point that precedes many of the big changes that usually happen. And we don't know how resistant she is — and that resistance is something we do think sets Olga apart." Those extra decades of pounding might break Raschker down or burn her out.

Motivation may ultimately be *the* issue. Finding reasons to keep exercising is a universal challenge. Even rats seem to bristle, eventually, at voluntary exercise, studies suggest. Young rats seem intrinsically driven to run on the wheels you put in their cages. But one day those wheels just stop turning. The aging athlete must manufacture strategies to keep pushing in the face of plenty of perfectly rational reasons not to: things hurt, you've achieved a lot of your goals and the friends you used to do it for and with are disappearing.

But competition can spur people on. "Maintaining your own records in the face of your supposed decline, providing evidence that you're delaying the effects of aging — these are strong motives," says Bradley Young, a kinesiology and sports psychology professor at the University of Ottawa. Young studies the factors that make track athletes want to continue competing into old age. A big one is training partners and family — both the encouragement they offer, and the guilt you'd feel letting them down if you quit. But the strongest motivating driver, Young found, was one's spouse.

In this way, too, Kotelko is unique. She has no husband, and though she does have some family — her daughter Lynda and son-in-law Richard, with whom she lives in Vancouver — they are not involved in her training.

IN ONE OF HER last duties to science on the Montreal trip, Kotelko lay serenely, under local anesthetic, on an examining table in the storied Montreal Neurological Institute, where Wilder Penfield mapped the human brain. "Contract your thigh muscle, please," Dr. José Morais said. The muscle shrugged up visibly when she tensed. The doctor began to draw out a little plug of tissue with a gleaming silver instrument that looked a bit like a wine corker. The sample would be frozen, and the fibers would later be examined.

Muscle is a decent barometer for the general health of a body. It contains what Hepple calls biomarkers of aging — changes over time in its structure, biochemistry, protein expression. These mark the body's decreasing ability to withstand the stresses it encounters — "some from outside us, like infections, and some

from inside us," like the cellular trash that builds up through normal body functions like breathing and metabolism. "In essence, they tell us how well Olga has handled the very things that cause most of us to age and die at or around age 80."

Hepple, in Kotelko's tissue sample, would be looking for the little angular muscle fibers that typically stop working as people age because they have come unplugged from the motor neurons, nerve cells that tell them to fire. Many researchers assume the problem is within the muscle cells. Hepple disagrees. He says those neighboring motor neurons aren't activating the muscle as they should, and he speculated that more of Kotelko's would be functioning properly.

Ideally, these two scientists would like to run a sample through genetic testing. Perhaps there are clues in Kotelko's genome that will help explain the thing that is so singular about her — not speed or power or prowess in any one event, but the resilience to endure all the stress of hard physical activity, year after year, without a hint of breakdown, and no end to the pattern in sight. "There could be a lot we find out in that biopsy," Taivassalo said, "that tells us what to ask next." Taivassalo intends to put together a larger sample size, at least 20 or 30 subjects, all old athletes. At that point the information starts becoming statistically significant, and patterns emerge. If the prospect of 30 more nominal Olgas spraying data points into unmapped space is enough to set the hearts of gerontologists aflutter, to Kotelko, the idea that there may be, somewhere, even one more older track star — a genuine rival — is tantalizing. She yearns, she insists, with semiplausible conviction, to be pushed. There'd be no talk of low-hanging fruit and meaningless medals if there were someone she could race close and beat in real time. "I'd love that," she told me more than once.

She may get her wish. Mitsu Morita, an 88-year-old from Japan, is faster than Kotelko was at that age and is breaking all of Kotelko's records in that age bracket. A Nike ad featuring Morita made her a minor phenomenon in Japan; there are clips of her orbiting the track, followed by laughing teenagers trying to keep up. In the 200, Morita's world-record time is almost 10 seconds faster than Kotelko's time in the 90-to-95 category. She claims she gets her strength from eating eel.

Morita is not a big traveler. If she can be persuaded to come to America for the world outdoor championships in Sacramento next summer, Kotelko will have her hands full.

In October, the first of Kotelko's muscle samples came back from the lab. The results were compelling. In a muscle sample of a person over the age of 65, you would expect to see at least a couple of fibers with some mitochondrial defects. But in around 400 muscle fibers examined, Taivassalo said, "we didn't see a single fiber that had any evidence" of mitochondrial decay. "It's remarkable," she added.

As the data on Kotelko gather, it's hard to avoid a conclusion. "Olga has done no more training than many athletes, and yet she's the one still standing," Hepple says. "Why? In my mind, it has everything to do with her innate physiological profile."

This sounds like discouraging news: she is not like us. But understanding Kotelko's uniqueness may provide benefits for others. We could learn a lot about why, for example, nerve cells die by studying someone in whom, for whatever reason, they seem to live on. And that, Taivassalo explains, may have implications for neuromuscular diseases like ALS — for which no current therapies have a meaningful impact. Drugs might be developed to, for example, somehow dial up the signals at that junction where the neurons are supposed to be telling muscles to move. Small molecular agents could target specific problem areas in aging muscles to make them more resilient. "At this stage it's all speculation," Hepple says. "But that's the direction we're moving. Because all the usual things don't seem to apply."

Presumably, at least some of the interventions that emerge will help mimic, for ordinary people entering their very old years, if not exactly Kotelko's performance on the track, at least something approaching the quality of her life.

This is the other story of the future of aging. When the efforts of medical science converge to simply prolong existence, you envision Updike's golfer Farrell, poking his way "down the sloping dogleg of decrepitude." But scientists like Taivassalo and Hepple have a different goal, and exercise — elixir not so much of extended life as extended youthfulness — may be the key to reaching it. James Fries, an emeritus professor at Stanford School of Medicine, coined the working buzz phrase: "compression of morbidity." You simply erase chronic illness and infirmity from the first, say, 95 percent of your life. "So you're healthy, healthy, healthy, and then at some point you kick the bucket," Tarnopolsky says. "It's like the Neil Young song: better to burn out than to rust." You get a normal life span, but in Olga years. Who wouldn't take it?

Bruce Grierson is the author of "U-Turns: What if You Woke Up One Morning and Realized You Were Living the Wrong Life?"

http://www.nytimes.com/2010/11/28/magazine/28athletes-t.html?src=me&ref=magazine

In 500 Billion Words, New Window on Culture

By PATRICIA COHEN

Kris Snibbe/Harvard University

Jean-Baptiste Michel and Erez Lieberman are co-authors of a Science paper coming about "culturomics."

With little fanfare, Google has made a mammoth database culled from nearly 5.2 million digitized books available to the public for free downloads and online searches, opening a new landscape of possibilities for research and education in the humanities.

The digital storehouse, which comprises words and short phrases as well as a year-by-year count of how often they appear, represents the first time a data set of this magnitude and searching tools are at the disposal of Ph.D.'s, middle school students and anyone else who likes to spend time in front of a small screen. It consists of the 500 billion words contained in books published between 1500 and 2008 in English, French, Spanish, German, Chinese and Russian.

The intended audience is scholarly, but a simple online tool allows anyone with a computer to plug in a string of up to five words and see a graph that charts the phrase's use over time — a diversion that can quickly become as addictive as the habit-forming game Angry Birds.

With a click you can see that "women," in comparison with "men," is rarely mentioned until the early 1970s, when feminism gained a foothold. The lines eventually cross paths about 1986.

You can also learn that Mickey Mouse and Marilyn Monroe don't get nearly as much attention in print as Jimmy Carter; compare the many more references in English than in Chinese to "Tiananmen Square" after 1989; or follow the ascent of "grilling" from the late 1990s until it outpaced "roasting" and "frying" in 2004.

"The goal is to give an 8-year-old the ability to browse cultural trends throughout history, as recorded in books," said Erez Lieberman Aiden, a junior fellow at the Society of Fellows at Harvard. Mr. Lieberman Aiden and Jean-Baptiste Michel, a postdoctoral fellow at Harvard, assembled the data set with Google and spearheaded a research project to demonstrate how vast digital databases can transform our understanding of language, culture and the flow of ideas.

Their study, to be published in the journal Science on Friday, offers a tantalizing taste of the rich buffet of research opportunities now open to literature, history and other liberal arts professors who may have previously avoided quantitative analysis. Science is taking the unusual step of making the paper available online to nonsubscribers.

"We wanted to show what becomes possible when you apply very high-turbo data analysis to questions in the humanities," said Mr. Lieberman Aiden, whose expertise is in applied mathematics and genomics. He called the method "culturomics."

The data set can be downloaded, and users can build their own search tools.

Working with a version of the data set that included Hebrew and started in 1800, the researchers measured the endurance of fame, finding that written references to celebrities faded twice as quickly in the mid-20th century as they did in the early 19th. "In the future everyone will be famous for 7.5 minutes," they write.

Looking at inventions, they found technological advances took, on average, 66 years to be adopted by the larger culture in the early 1800s and only 27 years between 1880 and 1920.

They tracked the way eccentric English verbs that did not add "ed" at the end for past tense (i.e., "learnt") evolved to conform to the common pattern ("learned"). They figured that the English lexicon has grown by 70 percent to more than a million words in the last 50 years and they demonstrated how dictionaries could be updated more rapidly by pinpointing newly popular words and obsolete ones.

Steven Pinker, a linguist at Harvard who collaborated on the Science paper's section about language evolution, has been studying changes in grammar and past tense forms for 20 years.

"When I saw they had this database, I was quite energized," he said. "There is so much ignorance. We've had to speculate what might have happened to the language."

The information about verb changes "makes the results more convincing and more complete," Mr. Pinker added. "What we report in this paper is just the beginning."

Despite the frequent resistance to quantitative analysis in some corners of the humanities, Mr. Pinker said he was confident that the use of this and similar tools would "become universal."

Reactions from humanities scholars who quickly reviewed the article were more muted. "In general it's a great thing to have," Louis Menand, an English professor at Harvard, said, particularly for linguists. But he warned that in the realm of cultural history, "obviously some of the claims are a little exaggerated." He was also troubled that, among the paper's 13 named authors, there was not a single humanist involved.

"There's not even a historian of the book connected to the project," Mr. Menand noted.

Alan Brinkley, the former provost at Columbia and a professor of American history, said it was too early to tell what the impact of word and phrase searches would be. "I could imagine lots of interesting uses, I just don't know enough about what they're trying to do statistically," he said.

Aware of concerns raised by humanists that the essence of their art is a search for meaning, Mr. Michel and Mr. Lieberman Aiden emphasized that culturomics simply provided information. Interpretation remains essential.

“I don’t want humanists to accept any specific claims — we’re just throwing a lot of interesting pieces on the table,” Mr. Lieberman Aiden said. “The question is: Are you willing to examine this data?”

Mr. Michel and Mr. Lieberman Aiden first started their research in 2004 on irregular verbs. Google Books did not exist then, and they had to scrutinize stacks of Anglo-Saxon texts page by page. The process took 18 months.

“We were exhausted,” Mr. Lieberman Aiden said. That painstaking work “was a total Hail Mary pass; we could have collected this data set and proved nothing.”

Then they read about Google’s plan to create a digital library and store of every book ever published and recognized that it could revolutionize their research. They approached Peter Norvig, the director of research at Google, about using the collection to do statistical analyses.

“He realized this was a great opportunity for science and for Google,” Mr. Michel said. “We spent the next four years dealing with the many, many complicated issues that arose,” including legal complications and computational constraints. (A proposed class-action settlement pertaining to copyright and compensation brought by writers and publishers as a result of Google’s digitization plans is pending in the courts.) Google says the culturomics project raises no copyright issue because the books themselves, or even sections of them, cannot be read.

So far, Google has scanned more than 11 percent of the entire corpus of published books, about two trillion words. The data analyzed in the paper contains about 4 percent of the corpus.

The warehouse of words makes it possible to analyze cultural influences statistically in a way previously not possible. Cultural references tend to appear in print much less frequently than everyday words, said Mr. Michel, whose expertise is in applied math and systems biology. An accurate picture needs a huge sample. Checking if “sasquatch” has infiltrated the culture requires a supply of at least a billion words a year, he said.

As for culturomics? In 20 years, type the word into an updated version of the database and see what happens.

http://www.nytimes.com/2010/12/17/books/17words.html?src=me&ref=general

Pakistan's Palette of Blood and Tears

By JANE PERLEZ

KARACHI, Pakistan — In this chaotic city of 18 million people, an exhibition of works by Pakistan's most significant contemporary artists shows just how imbued with violence daily life here is: on the street, in the air and in the debate about the future course of the nation.

Installed in the elegant rooms of the Mohatta Palace Museum, a confection of Mughal architecture in pink stone, the exhibition, "The Rising Tide," includes more than 40 canvases, videos, installations, mobiles and sculptures made in the past 20 years. Its curator, the feminist sculptor and painter Naiza Khan, said her aim was to show the coming of age of Pakistani art, which blossomed when censorship was lifted after the death of the American-backed Islamic dictator Gen. Zia ul-Haq.

Violence was not an intended theme. "I wanted the works to reflect the many strands of the urban condition," Ms. Khan said in her light-filled studio in an upscale neighborhood here.

But the corrosive impact of Pakistan's struggle with Islamic militants, its tortured relationship with the United States and the effects of an all-powerful military pervade the show.

The artist Abdullah Syed, for example, assembled a fleet of drones — the pilotless American aircraft that fire missiles at militants in Pakistan's tribal areas — constructed from the blades of box cutters, the very instruments used by some of the 9/11 attackers. They float on wires just above the viewer's head, the silvery blades shimmering menacingly in bright light.

A second fleet of drones is constructed from dollar bills folded into the shape of the planes and stapled together in circular patterns that resemble those of an oriental carpet. Called the "Flying Rug," the paper fleet casts an ominous shadow on a nearby wall.

Mr. Syed, one of several artists in the show pursuing a career abroad, teaches at the University of New South Wales in Australia. "I'm always navigating ideas between the West and here," he said, perched on a ladder as he hung his killer fleets. The "Flying Rug" takes sides: "I'm saying, 'To hell with Uncle Sam.' "

Though in the West the drones are often seen as an essential element in the fight against terrorism, in Pakistan they are considered imperial interference by the United States, he said. In the show's catalog Mr. Syed notes that according to one estimate, drones have killed more than 1,000 Pakistani civilians since 2004. Many more civilians have fled the tribal areas and settled in Karachi to escape the attacks, an influx that has sharpened the city's political tensions.

In recent years work by Pakistani artists has begun appearing in museum shows outside the country — in Paris, London and Dubai. Ms. Khan wanted to bring them home, to show the strength and variety of their projects. Among her choices are Rashid Rana, whose "Desperately Seeking Paradise," a huge metal cube covered in photographs of the dilapidated residential buildings of Lahore, appeared at the Musée Guimet in Paris recently; and Imran Qureshi and Anwar Saeed, whose works appeared in "Hanging Fire," a survey of Pakistani art at Asia Society in Manhattan last year.

Mr. Qureshi is a leader in the modern school of Pakistani miniature painting derived from the court painters of the Mughal era. But rather than paint delicate images of princes and princesses, modern miniaturists have expanded their vocabulary. Ms. Khan chose a Qureshi miniature of a missile, painted after Pakistan conducted nuclear tests in 1998. Also on display is a large-scale triptych panel by Mr. Qureshi of drips and splotches executed in a lush pomegranate hue. Or is that the color of blood?

Part of what differentiates this exhibition from the recent shows of Pakistani art in New York and Dubai is the inclusion of young people fresh out of the country's growing number of art schools.

Sara Khan, 24, a recent graduate from the art department at Karachi University, is from the Pashtun ethnic group, whose traditional homeland is in the turbulent tribal areas in northwest Pakistan, where the army is embroiled in fighting militants. To escape the lack of development in the region, many Pashtuns have moved to Karachi in the past 30 years, among them Ms. Khan's relatives.

Ms. Khan, who was born here and has never been to the tribal areas, doesn't even speak Pashto. "They call me a fake Pashtun," she said in an interview.

In her work Ms. Khan uses emblems of Pashtun culture painted in the style of a children's primer on pages sized to resemble a school exercise book. Among the images: an AK-47 rifle — the standard-issue weapon of the tribal zone — a bullet and a series of domestic items, including bread, milk and eggs.

"Pashtuns are very strong, but I am showing emblems in a soft way," she said. I am saying, 'We are not exactly what you think we are.' " A simple two-part work by Risham Syed reflects the violence that many urban, middle-class Pakistanis feel. A red wall lamp similar to those that hang in the homes of the well-to-do in Lahore, in northeastern Pakistan, is juxtaposed with a tiny 4-by-6-inch canvas, painted in a brutally realistic style. It shows a lone man in Islamic religious garb futilely trying to damp down a wall of flames that engulf a building. Ms. Syed, who teaches art at Beaconhouse National University in Lahore, seems to be edging close to the question some Pakistanis are raising gingerly about the responsibility of extremist clergy for the wave of suicide bombings in the nation's cities.

Ms. Khan, the curator, took a year away from her studio in Karachi to put the show together. She felt strongly, she said, that even though fear and violence emerged as central themes in the art, Karachi should be seen as more than just a city of gangland killings and ethnically directed shootings.

"It means a lot to me to bring art center stage at a time when so much is denied in the country," she said.

http://www.nytimes.com/2010/12/18/arts/design/18rising.html?ref=design

Reflections on the Self and the Wider World

By ROBERTA SMITH

Lori Waselchuk for The New York Times

Visitors circumnavigate Michelangelo Pistoletto's "Globe," a ball of newsprint that has had occasional rolls through the streets, at the Philadelphia Museum of Art.

PHILADELPHIA — Signs of genuinely vital artistic life are irregular in the Philadelphia Museum of Art's ambitious survey of early work by the innovative Italian postwar artist Michelangelo Pistoletto. But it is not for lack of trying.

In a way that is becoming increasingly rare in these days of shrinking exhibition budgets, the Philadelphia Museum has gone all out for Mr. Pistoletto, now 77. A prominent yet mysterious polymath, he is best known for his Photo Realist mirror paintings and for helping to lay the cornerstones of Arte Povera, the polyglot Italian precursor to Post Minimalism. In recent years he has also been anointed a forefather of interactive art and relational aesthetics and has devoted much of his energy to Cittadellarte, a foundation he started in 1998 in a stately former textile mill in his birthplace, Biella, Italy. Its goal, according the foundation's Web site, is "to inspire and produce responsible change in society through ideas and creative projects."

"Michelangelo Pistoletto: From One to Many, 1956-1974" crowds the museum's generous temporary exhibition galleries with some 200 artworks in assorted mediums and comes with an impressive catalog that seems to leave no stone unturned. Yet, while lavish and illuminating, the show is also oddly listless, even hollow.

One question continually nags: Does Mr. Pistoletto's art, its influence aside, hold up to the test of immediate experience. This exhibition has a time-capsule, period-piece atmosphere. It does not inspire confidence that

Carlos Basualdo, the museum's curator of 20th-century art and the show's organizer, mostly ignores the last 35 years of the artist's work. That omission is only partly mitigated by "Cittadellarte," a second exhibition of two immense mirrored table sculptures — one shaped like the Mediterranean, the other like the Caribbean — surrounded by chairs, all from Mr. Pistoletto's foundation. This stylish seminarlike installation is intended to symbolize collective action and community — although it looks a trifle dangerous — and is being used by the museum's education department during the show.

Caveats aside, anyone seriously interested in the history of postwar art should see this show. Its bright spots shine, and its insights — advertent and inadvertent, regarding past and present — are valuable.

The exhibition begins in 1956, when Italy was just beginning to emerge from the devastation of World War II, and Mr. Pistoletto was the 23-year-old son of a conservative Italian painter determined to become less conservative than his father. During the next 18 years he succeeded, one suspects, beyond his wildest dreams, becoming a force on the turbulent Italian cultural scene of the 1960s and early '70s.

He first emerged in the early '60s with the mirror paintings: quasi-photographic life-size images of people and objects on polished stainless steel. He traveled to New York several times, consorting with the Pop artists and ignoring Leo Castelli's advice that he move there.

By the mid-'60s, still producing the mirror paintings, he branched into sculpture in the direction of Arte Povera and its process-oriented focus on abject, casually arranged materials. He also threw open his studio for collaborative, Happening-like events executed with actors, filmmakers and musicians, signaling the interest in participatory art that would increasingly become his focus.

By the late '60s he was making fewer art objects, concentrating instead on an improvisational performance group called Lo Zoo. A photograph taken during one of Lo Zoo's street actions shows Mr. Pistoletto crouched on the cobblestones, looking like a slightly crazed tramp. It provides one of the show's stranger, more gripping moments, emphasizing the gaps in general knowledge about Italian art of the '60s and whetting the appetite for filling them. But more often the show underscores the elusiveness of improvisation and performance art. You had to be there.

And it is not clear if even that was always so much fun. The silent, patched-together films in the exhibition drag, never seeming to arrive at any point. In one a beautiful young woman, soon to be Mr. Pistoletto wife, yawns noticeably while he instructs her on how to move. Exactly. In another film he spends a great deal of time arranging a ruff collar made of plastic sheets around her neck, while several handsome, bare-chested young men loll about looking bored. The saving grace here is more than two centuries old: the glorious strains of Mozart's Mass in D minor on the soundtrack.

Something similar happens in the "Cittadellarte" installation, where one of the immense mirrored tables is surrounded by a marvelous selection of oddball chairs, stools and benches in different styles and materials. Under the circumstances you take your artistic vitality where you can find it.

In the opening gallery of "From One to Many" the best work is the earliest and the least like its neighbors: a scabby rust-colored image of a large Expressionist face. Otherwise the dominant images are vague, suave full-length self-portraits: they show Mr. Pistoletto facing forward wearing a suit and suggest an admiration for both Francis Bacon and the sleekly tailored Marcello Mastroianni. The unexpected reflections in the dark gleaming backgrounds of these paintings led Mr. Pistoletto to the mirrored surfaces.

Mr. Basualdo is especially intent on claiming Mr. Pistoletto as a forerunner of interactive art and relational aesthetics, starting with the way the mirrored surfaces reflect their surroundings, viewers and all. In theory, at least, these works are never the same twice, and yet they are always the same: despite changes in subject

matter and setting, they have essentially the same gimmicky effect. Look, a painting with me, or us, in it. Tellingly, the mirror paintings appear most interesting in photographs in the catalog, where images and the reflections are difficult to tell apart, which is not the case in real life.

While Mr. Pistoletto's mirror paintings show little growth, his sculptures are abundant with fresh ideas left mostly to other artists to develop. The main show's liveliest section is three consecutive galleries devoted to sculpture. Two feature works involving piles of colorful rags, small stacks of bricks individually covered in fabric and low-lying arrangements of reflective Mylar, glass and candles that are among Mr. Pistoletto's contributions to Arte Povera.

Especially compelling is a large gallery devoted to his varied "minus objects," a slightly too-crowded sprawl of wildly heterogeneous sculptures. One outstanding work is the brawny "Lunch Painting," which consists of a table and two seats built into a wood-plank frame; it cries out for occupants while mocking geometric abstraction. More generally it is impossible to imagine the career of Martin Kippenberger without this marvelous disarray and its eccentric variations on Minimalist cubes and tables.

My all-time favorite Pistoletto, the 1966-68 "Globe," is here: a nearly one-off effort that predicts the entire career of Franz West, the Austrian whiz at creating usable papier-mâché sculpture. "Globe" is a very large, solid ball of newsprint that has been burnished to a glowing brown by time and occasional rolls through the streets, the latest having taken place in Philadelphia the day this exhibition opened.

Inside the museum it sits on the floor, caged in a larger wire sphere that adds intimations of longitude and latitude. Mr. Pistoletto is completely present in this unforgettable piece.

He is an artist of many contradictions. Despite the seemingly modest altruism of his foundation, he has lately returned to public view with performances involving the smashing of large mirrors, including an event in Paris last weekend in which a falling mirror narrowly missed a fellow performer. Whether or not these performances suggest Mr. Pistoletto's resentment of his signature material, they redirect our attention to the artist as flamboyant, temperamental persona, dominating center stage.

WHEN AND WHERE Through Jan. 17, Philadelphia Museum of Art, 26th Street and Benjamin Franklin Parkway.

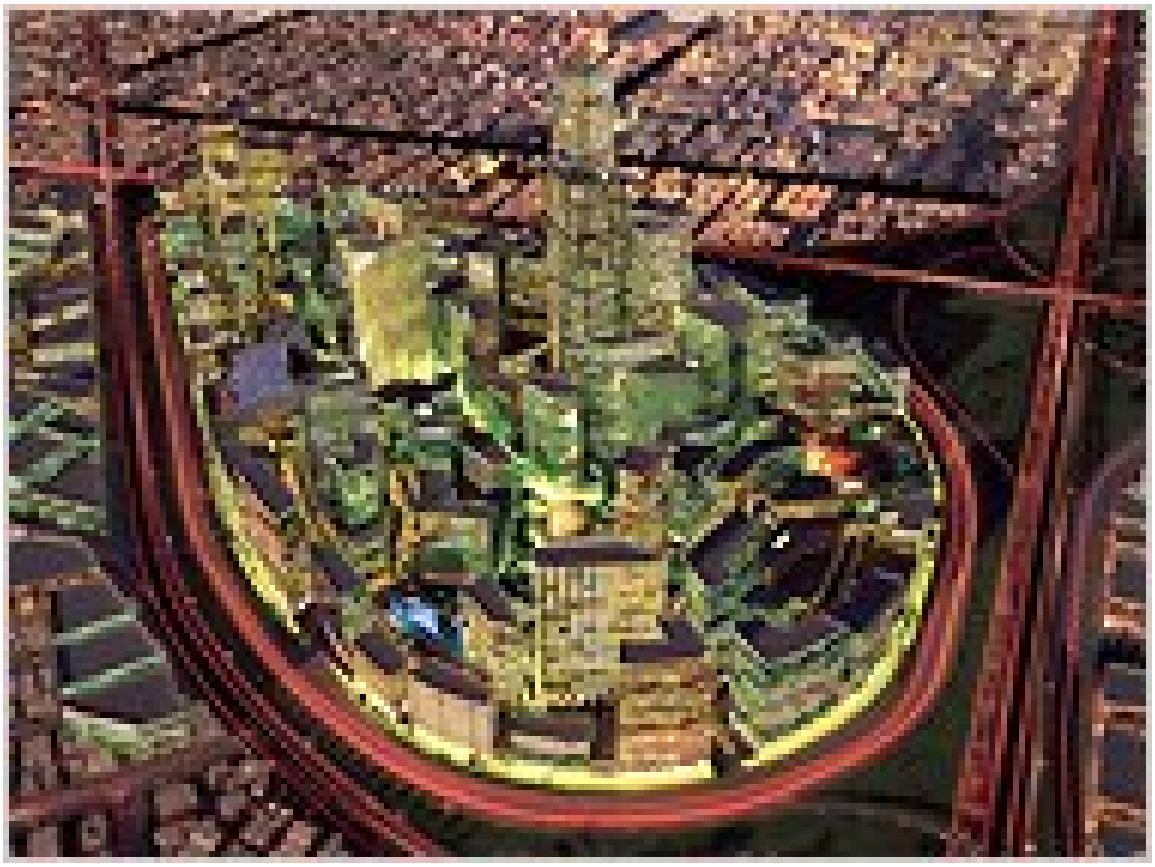
MORE INFORMATION (215) 763-8100, philamuseum.org.

PHILADELPHIA BITES: Figs, 2501 Meredith Street, (215) 978-8440, figsrestaurant.com; L'Oca, 2025 Fairmount Avenue, (215) 769-0316, locafairmount.com; Rose Tattoo Cafe, 1847 Callowhill Street, (215) 569-8939, rosetattoocafe.com.

http://www.nytimes.com/2010/12/17/arts/design/17pistol.html?ref=design

Saudi Urban Projects Are a Window to Modernity

By NICOLAI OUROUSSOFF



Henning Larsen Architects

A computer rendering of the King Abdullah Financial District on the outskirts of Riyadh

JIDDA, Saudi Arabia — Just off a desert road about an hour's drive from this port city, an enormous arched gate capped by three domes rises out of the sand like the set for a 1920s silent film fantasy. It is, instead, a fantasy of contemporary urban planning, the site of what one day will be King Abdullah Economic City, a 65-square-mile development at the edge of the Red Sea. With a projected population of two million, the city is a Middle Eastern version of the "special economic zones" that have flourished in places like China.

The city is one of four being laid out on empty desert around this country, all scheduled for completion by 2030. They follow on the heels of the country's first coeducational university, which opened last year next to the King Abdullah site, and a financial district nearly the size of Lower Manhattan that is rising on the outskirts of the capital, Riyadh.

Architecturally they couldn't be more dreary and conventional — bloated glass towers encircled by quaint town houses and suburban villas decorated in ersatz historical styles. Their gargantuan scale and tabula rasa

approach conjure old-style Modernist planning efforts like the creation of Brasília in the 1950s or the colossal Soviet urban experiments of the 1930s, but these are driven by anxiety over the future, not utopian idealism.

With more than 13 million Saudis — half the population — under 20, the 86-year-old Saudi ruler, King Abdullah, is trying to create more than a million new jobs and 4 million homes within 10 to 15 years. He and his royal clan envision an economy less dependent on oil, run by a new class of doctors, engineers and businessmen who can function in a global marketplace.

To accomplish this feat the Saudi government says it needs to crack the door open to some sort of Western-style modernity — or at least a softer version of the Islam practiced here, with its strictly enforced separation of the sexes, its severe restrictions on the public lives of women and the ever watchful eye of the religious police.

The idea is to create islands from which change would seep out, drop by drop, without antagonizing powerful conservative forces within the country.

If the plan works, at best it would transform Saudi Arabia into a technologically advanced society controlled by a slightly more tolerant religious autocracy. Or it could provoke militant violence and government crackdowns.

“What they are trying to do is very difficult,” said Bernard Haykel, a professor of Near Eastern studies at Princeton University who has written extensively on Saudi Arabia. “Someone telling you to go pray — that in-your-face religion — that’s not going to be permitted in these cities. It’s a more ecumenical Islam. But it’s a slippery slope. Once you start, you’ve basically opened up the door to a certain degree of diversity and tolerance.”

Urban Fortresses

In many ways Saudi Arabia looks like a modern country. Riyadh was laid out on a rationalist urban grid in the 1960s by Constantinos Doxiadis, a postwar Modernist planner. King Fahd Road, its main axis, is a multilane highway that cuts the city in two and is dotted with recognizable landmarks: Kingdom Center, a skyscraper known as “the bottle opener” because of a triangular hole at the top, designed by the American firm Ellerbe Becket; Norman Foster’s pointy Al Faisaliah tower; and the headquarters of the Interior Ministry, a menacing upside-down concrete pyramid that looms just off the main strip.

Underneath the modern gloss, however, the city’s architecture reflects the strictures of the Saudis’ severe Wahhabi brand of Islam. Public parks — where men and women might mingle — are few; restaurants have separate dining areas for men and women; banks have separate entrances; and cinemas are banned. Many windows are covered by modern versions of mashrabiyas, traditional latticework screens, to ensure privacy. Men and women avoid riding elevators together. The most open public spaces are hotel lobbies, where women sometimes show their faces.

When I visited recently, the steel frames of the financial district’s first towers could be seen rising at the city’s northern edge, just beyond a ring road. According to the government, this will one day be the financial center of the entire Middle East, and the design blends elements of Wall Street, La Défense in Paris, and Canary Wharf in London into a kind of generic financial theme park.

At the heart of the plan is Financial Plaza, a sterile limestone square framed by a stock exchange and several bank towers. (One of the tallest is named the World Trade Center.) These will be surrounded by more corporate towers, nearly 50 in all, that will stand at irregular angles to one another and rise out of a two-story

retail base linked by skywalks. A monorail will loop through the site, with stops at a planned children's museum, a science exhibition center and the country's first aquarium.

The public spaces are closer in spirit to Las Vegas than to Riyadh. An elaborate pedestrian promenade will zigzag through the site, flanked by a narrow reflecting pool intended to conjure a traditional wadi, the mostly dry riverbed that runs through desert valleys. Branches of the "wadi" will connect to small public squares that the architects envision as social meeting places.

Even more striking is that the design guidelines say nothing about the separation of the sexes. Jacob Kurek, a partner at Henning Larsen, architects of the master plan, showed me apartment layouts no different from those in a standard residential high rise in New York or London. Many have floor-to-ceiling windows, allowing people to stare directly into them.

Meanwhile the seven mosques that were part of the original master plan have been reduced by more than half, and most of the daily worship will take place in public prayer rooms tucked into buildings.

"None of the religious issues came into the design in any way," Mr. Kurek said. "They want to attract a bit of both Westerners and young Saudis who have traveled abroad, in order to integrate them."

But this integration stops at the district's edge. Highways surround the site, isolating it within rivers of traffic. Many of the meandering streets created by the wadi dead-end in cul-de-sacs, adding to the feeling of disconnection from the street grid of Riyadh. Most people will enter by car, parking on one of four underground levels and riding elevators to street level. Once inside they will walk among buildings through more than two miles of air-conditioned skywalks, a vision that seems to have been airlifted from cold-war-era Houston.

In part the district's isolation stems from the Saudis' security concerns. The master plan lays out the advantages of an "island site" that would allow authorities to restrict comings and goings as well as to shut down the entire district if there is a security alert. (A similar plan is being designed for ground zero in Manhattan.)

As important, however, is that the isolation of the site will keep its vision of modernity from close contact with Riyadh's strictly monitored society, at least too soon. When it is completed, sometime in 2012, the Financial District will be its own world. Over the next decade, as the city grows around it, and the country continues to modernize, the two would become more closely integrated. Eventually, they expect, it will be linked to central Riyadh by a tram system.

A Test for Integration

King Abdullah Economic City — KAEC (pronounced "cake"), as the Saudi government calls it — is envisioned as another island of relative liberalism within Saudi Arabia. For now, just beyond the gate, a roadway flanked by shrubs, palm trees and the occasional billboard of King Abdullah extends through miles of empty desert. At its far end the first stages of development rise: some tinted glass corporate office buildings, a long row of town houses and a pedestrian boardwalk overlooking the turquoise waters of the Red Sea.

According to the agency in charge of developing the economic cities, this cluster of buildings will blossom into a walled city with 400,000 apartments, town houses and villas; a central business district; an industrial zone; a 250-acre university campus; and one of the world's largest and most technologically advanced ports.

"The whole objective is job creation," said Amr al-Dabbagh, the agency's governor. "The biggest oil refinery produces at most 1,500 jobs. We will produce a million."

Despite the occasional Islamic-style embellishments — a villa with an arched entryway, a trellised porch — the developments bring to mind the camps built here by Aramco, the American oil conglomerate, for its executives and workers in the 1950s and '60s. Like this new city those camps were sealed enclaves, re-creations of American-style subdivisions complete with front lawns, backyard barbecues and baseball diamonds. And they followed what were known as "Aramco rules": women were allowed to walk around unveiled, drive cars and mingle with men.

But KAEC is Aramco with a twist. Conceived on a larger scale, economically and socially more diverse, it aims to draw a range of Western corporations and their employees, as well as their expertise, to create a social mixing chamber. The core of the city will be a business district much like the one on the outskirts of Riyadh. Residential areas will be interlaced with the kind of open public spaces — parks, plazas and the waterfront promenades — that are generic in large Western-style developments but almost impossible to find in Saudi Arabia.

Artists' renderings of the project show couples happily strolling around the city dressed in an ambiguous mix of Islamic and Western styles. A video of the future university has women, their heads covered but otherwise in Western-looking dress, mingling with men on campus. To encourage more foreign companies and their employees to come here, the government will allow foreign ownership for the first time. And officials say the city will have a streamlined bureaucracy, so that unlike in other Saudi cities, where delays can make even the simplest transactions stretch out for days, action on visas or customs documents will take just an hour.

Ahmed Osilan, Mr. Dabbagh's chief of staff, explained the difference between King Abdullah Economic City and the old Aramco camps this way: It is "not an Aramco town — it will have a mix of foreigners and nationals — but Aramco rules." He added, "The coeducation, the mixing — they're tools for bringing about various changes the king wants."

Eventually KAEC is supposed to be joined by three other cities: Knowledge Economic City on the outskirts of Medina, the burial place of Muhammad and one of the Arab world's holiest cities; Prince Abdulaziz bin Mousaed Economic City, 450 miles north of Riyadh, which will focus on agribusiness; and Jazan Economic City, intended to provide industrial jobs to Saudis living near the border of Yemen, a stronghold of Al Qaeda that has become one of the most volatile areas in the Middle East.

"The economic cities are unique," Mr. Osilan said, explaining the government's thinking. "They are contained developments. Should they succeed they will be contagious to the neighboring region. Should they fail it is still contained."

A Fine Line

But that kind of containment may be difficult in the age of Facebook and Twitter. Only a year ago the king attended the opening of Saudi Arabia's first coeducational graduate school, the King Abdullah University of Science and Technology, a 10-minute drive from the King Abdullah site. From the desert outside, the campus looks like a military encampment: 800 acres surrounded by a ring road and a concrete and steel wall.

Inside, I was told, the development is organized around a town square that links the university buildings to a residential area for up to 25,000 people. There are no strict religious dress codes — women can walk around in shorts if they choose — and anyone can drive. Aramco rules.

Yet soon after the campus opened, a two-minute video showing men and women dancing in the school's cafeteria made its way to YouTube, outraging religious hard-liners. When a member of the Saudi Council of Senior Scholars, Sheik Saad al-Shathry, openly criticized the university, calling it evil, the king promptly fired him. Security was beefed up, and people involved in the project were forbidden to speak to the news media about "social issues" regarding the university — meaning women. Trying to visit, I drove through an obstacle course of security bollards before being turned away at the front gate.

The clampdown underscores the delicate game the government is playing. "There has been resistance since the 1960s to any innovations that are deemed too Western — to television, to girls' education," said F. Gregory Gause III, a specialist in Middle Eastern politics at the University of Vermont. "But that hasn't stopped them from happening. Even the most conservative sheik drives an S.U.V. and has a nice house. He's not living in the desert in a tent." At the same time, he went on to say, a thirst for the material luxuries that the modern world can provide can't be equated with demands for political rights — something that he doesn't see happening here soon.

"Even lots of women are afraid of change," said Eman al-Najaf, a 31-year-old Saudi who blogs about women's issues here. "Women who have been educated have been educated to stay the same. They've been brainwashed and prefer to live in their comfort zone."

Several people here expressed outrage that the government was pouring billions of dollars into the creation of entire new cities while large areas of existing ones had deteriorated into slums. Jidda, for example, already has a port in desperate need of upgrading. Its historic center is a medieval slum inhabited by foreign laborers. The city has no sewer system, only septic tanks that regularly spill into the streets. And people who live there will have to continue living by the old rules.

"Here you have a long historical pattern of settlement," said a local architect, Tariq Alireza, expressing a frustration I encountered again and again here. "There is an inordinate amount of vacant land. Why not solve our problems? Why not fix the port in Jidda? We're not Saudi Arabia? What law will apply here?"

If the government's vision fails — if it cannot manage the forces of liberalism within its planned developments — it could set off more intense clashes with militant forces that could ripple across the Middle East and the West. A more likely outcome is that, as resistance from the country's conservative religious establishment grows, the government will ratchet up its mechanisms of oppression.

But an even bigger danger, some say, may be that the government won't move forward at all.

"You're looking at decades," Mr. Haykel said. "If these cities don't work, and they can't produce jobs and, say, the price of oil drops, you could have masses of people mobilizing against the government, and it could take the form of religious extremism. But in the long run if they don't produce an economy that's not dependent on oil, the country itself becomes unviable. I don't know how they would be able to sustain life there. It's an end-of-the-world scenario."

http://www.nytimes.com/2010/12/13/arts/design/13desert.html?ref=design