Infoteca's E-Journal

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

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Presentation

Higher education in the globalized world is impossible to conceive without the use of the English Language. A very large amount of the information materials relevant to the curriculum, are published in this language, it is a fact that so many of them will not be translated into Spanish in time to be useful during our studies, and in the worst scenario, will never be, which means that the very lack of an elemental tool, may leave us out not only in the educational ground, bout also in our professional career.

One of the proposals of Rector Mario Alberto Ochoa Rivera to heighten the quality of the education they receive in the Universidad Autónoma de Coahuila, is precisely that each student, al the moment of finishing his studies, will have a sufficient use of the English Language.

The Sistema de Infotecas Centrales, conscious of its responsibility to the academic community, and specially to the projects of the Rectory, has decided to join in to the University's efforts, offering the community such diverse reading materials that not only serve as a practice to what is learned in the Language Centers, Faculties and Schools, but a motivation to go deep into science, culture and arts, not anymore as part of their education, but as a field exploration to make their own contributions and construct the highest professional satisfactions.

Our experience of three years of publishing the Boletín científico y Cultural de la Infoteca will let us offer you an E-Journal weekly, which we hope will be an invitation to get near the boundaries of human thought, and to go beyond.

SIC

Presentación

La educación superior en el mundo globalizado no se concibe sin el dominio del idioma Inglés. Gran parte de los materiales de información relevantes para la formación, se publican en ese idioma, siendo la realidad que muchos de ellos no serán traducidos al Español con suficiente prontitud para sernos útiles durante nuestros estudios, y en el peor de los casos, nunca, con lo que la carencia de una herramienta tan elemental, puede marginarnos no solo en el ámbito educativo, sino también en el desempeño profesional.

Una de las propuestas de trabajo del Rector Mario Alberto Ochoa Rivera para la elevación de la calidad de la educación que los estudiantes reciben en la Universidad Autónoma de Coahuila, es precisamente la de que cada alumno, en el momento de egresar, tenga un dominio suficiente del Idioma Inglés.

El Sistema de Infotecas Centrales, consciente de su responsabilidad para con la comunidad académica, y específicamente con los proyectos de desarrollo institucional de la Rectoría, ha decidido sumarse al esfuerzo universitario, ofreciendo a la comunidad diversos materiales de lectura que no solo sirvan para ejercitar lo aprendido en los Centros de Idiomas, las Escuelas y Facultades, sino que motive a los alumnos a adentrarse en la ciencia, la cultura y las artes, ya no como parte de su formación, sino como campo para hacer sus propias aportaciones y lograr las máximas satisfacciones profesionales.

La experiencia de tres años de publicar el Boletín científico y Cultural de la Infoteca nos permitirá ofrecer semanalmente un E-Journal que esperamos sea una invitación a acercarse a los horizontes del pensamiento humano, y a ir más allá.

SIC

Superbug: What makes one bacterium so deadly

Sarah C. Williams

Some of the most aggressive antibiotic-resistant staph infections gain their advantage with a molecule that punctures the immune cells trying to fight off the bacteria, scientists have discovered. Understanding the role of this molecule in methicillin-resistant *Staphylococcus aureus* (MRSA) could lead to new therapies for the notoriously hard-to-treat, and sometimes fatal, skin infection.

Staph bacteria are ubiquitous but aren't dangerous unless they seep into an open wound. Even then, antibiotics will usually stop the infection. But some strains of staph that infect hospital patients with weakened immune systems have become resistant to all standard antibiotics, including methicillin.

Now, a newer strain of the flesh-eating disease has swept through schools, day care centers, health club locker rooms, and prisons. So-called community-associated MRSA (CA-MRSA) typically afflicts healthy people because it's especially effective at causing infections in the first place. For now, it's resistant only to methicillin, but scientists fear that it will become resistant to other antibiotics.

In the Oct. 17 *Journal of the American Medical Association*, Monina Klevens of the Centers for Disease Control and Prevention in Atlanta and her colleagues gave the first statistics on just how widespread MRSA has become. The researchers estimated that 94,360 cases occurred in 2005, leading to 18,650 deaths. They argued that these numbers are on the rise, particularly outside the hospital setting. In a separate study, Michael Otto of the National Institute of Allergy and Infectious Diseases and his colleagues found a molecule involved in CA-MRSA's success.

While studying small molecules that help a different bacterium, *Staphylococcus epidermidis*, fight its host, the scientists decided to check whether MRSA carried a similar molecule. They found that CA-MRSA had much more of a protein called phenol-soluble modulin (PSM) than the less virulent MRSA strains associated with hospitals had.

"Different bacteria have different strategies to attack the human immune system," explains Otto. *S. aureus* "seems to have a lot of strategies, it's really good at that." The team elucidated PSM's importance by isolating the protein and adding it to white blood cells called neutrophils, which usually engulf and destroy bacteria that enter the body. PSM molecules destroyed neutrophils by forming pores on the cells, letting their contents leak out.

Otto's team then injected mice with a form of MRSA engineered to lack the PSM gene. After a day, those mice were still alive, but more than half of a group of mice exposed to normal MRSA had died. The results appear online and in an upcoming *Nature Medicine*.

Until last year, most scientists had focused on a different protein, called Panton-Valentine leukocidin (PVL), as the key to CA-MRSA's deadliness, because it's far more abundant in CA-MRSA than in the hospital-associated strain. But Otto and his colleagues showed that deleting PVL from the bacterium does not make it less deadly. Lindsey Shaw of the University of South Florida in Tampa says that the jury is still out on PVL, and while he calls the findings on PSM "incredibly important," he also notes that it doesn't explain the virulence of all strains of MRSA.

"There are strains that don't make these molecules, and they still kill people," he says. Both Shaw and Otto note that the ability of staph bacteria to adapt quickly to new environments is what allows different strains to express different molecules and become so dangerous.

"This is just another niche it's exploited," says Shaw. "Some shift may have happened where some strains started [making PSM] and it turned out to be favorable."

http://www.sciencenews.org/articles/20071117/fob1.asp

Flawed Stem Cells Yield Fragile X Clues: Researchers study genetic disorder via discarded embryos

Brian Vastag

Scrutinizing the first days of development in abnormal embryonic stem cells, researchers have uncovered a basic mechanism underlying fragile X syndrome, the most common inherited cause of mental retardation in boys.

"It could have important implications for treatment," says W. Ted Brown, cochair of the scientific committee of the National Fragile X Foundation, which helped fund the work.

The research also highlights the value of embryonic stem cells for studying genetic diseases, says Yang Xu, a stem cell researcher at the University of California, San Diego.

Fragile X syndrome is caused by a mutation in a gene called *fmr1*. By stopping the gene from making its protein, the mutation leads to learning disabilities, elongated facial features, speech and language difficulties, emotional problems, and other symptoms. In boys, who have only one copy of the X chromosome, a single bad *fmr1* gene inherited from either parent induces the disorder. Fragile X syndrome more rarely affects girls, who have two X chromosomes.

While researchers have long known that the fragile X mutation shuts down the gene, they were unsure how or at what developmental stage the disruption occurs. To study the shutdown, Nissim Benvenisty and his colleagues at the Hebrew University in Jerusalem created three embryonic stem cell lines carrying the mutation.

The cells came from embryos donated by couples with a family history of fragile X syndrome who visited an Israeli in vitro fertilization (IVF) clinic. Many IVF clinics now offer pre-implantation genetic diagnosis (PGD), which identifies genetically flawed embryos.

To do a PGD, technicians pluck one cell out of a 3-day-old, eight-cell embryo. Tests then reveal whether the cell—and hence the embryo—carries specific mutations. If it does, the embryo normally is "discarded immediately," says Benvenisty. But his team instead received consent from the couples to study any embryos carrying the fragile X mutation. The team grew several such embryos for about 5 days—to a stage called a blastocyst—and then teased stem cells out of the structure's inner wall.

Despite carrying the fragile X mutation, the embryonic cells unexpectedly produced the fmr1 protein. "We were extremely surprised," says Benvenisty. But when the team prodded the cells to begin developing into a range of tissues, the gene promptly shut down. "The [mutation] itself is not sufficient for the gene silencing," says Benvenisty. "Something happens during development."

Delving further, the team determined that changes in the gene's wrapper, a structure called chromatin, switched off the gene. Those changes occur only after cells grow out of their embryonic state, presenting a window of opportunity for drug therapy, says Benvenisty. In addition, chromatin is easier to modify than the gene itself. His team is now screening drugs that might prevent the gene silencing by fixing the chromatin.

Other teams have created stem cells from embryos carrying genetic diseases, but Xu says that this is the first time the method has yielded a fundamental disease discovery. The study appears in the November *Cell Stem Cell.*

http://www.sciencenews.org/articles/20071117/fob7.asp

Shadow World

How many dimensions space has could all be a matter of perspective

Davide Castelvecchi

In a school of thought that teaches the existence of extra dimensions, Juan Maldacena may at first sound a little out of place. String theory is physicists' still-tentative strategy for reconciling Einstein's theory of gravitation with quantum physics. Its premise is that the subatomic particles that roam our three-dimensional world are really infinitesimally thin strings vibrating in nine dimensions. According to Maldacena, however, the key to understanding string theory is not to add more dimensions but to cut their number down.

In his vision, the mathematical machinery of strings completely translates into a more ordinary quantum theory of particles, but one whose particles would live in a universe without gravity. Gravity would be replaced by forces similar to the nuclear forces that prevailed in the universe's first instants. And this would be a universe with fewer dimensions than the realm inhabited by strings.

Just as a hologram creates the illusion of the third dimension by scattering light off a 2-D surface, gravity and the however many dimensions of space could be a higher-dimensional projection of a drama playing out in a flatter world.

In physics parlance, the two theories would be dual to each other—two mathematically equivalent languages for describing the same reality. Physicists could study each phenomenon using whichever language that makes it easier to understand.

Maldacena first presented his conjecture in November 1997, and it quickly became a leading theme in string theory research. Ten years later, physicists still don't have proof of it, though many have tried and thousands of papers have been written. But hints have been accumulating, and recently experts have found "very strong evidence" that the conjecture is true, says Maldacena, now at the Institute for Advanced Study in Princeton, N.J.

Meanwhile, the work by Maldacena and others has helped clarify a nagging paradox about black holes, gravity's most extreme phenomena, by translating the problem into ordinary quantum theory. Physicists have also used the dictionary in reverse, turning problems about real-world particles such as quarks into questions about how seismic waves shake black holes. Surprisingly, the black hole calculations have often turned out to be more manageable than the original form of the problem.

But the most important fallout from Maldacena's intuition has probably been on the field of string theory itself. His work has offered physicists hope that they can make the string idea rigorous by tracing its roots to ordinary quantum physics. Maldacena's conjecture has energized string theory advocates, occupying the center of a confluence of ideas coming from several branches of physics. "It's the most incredible discovery in theoretical physics in the last 20 years," says Harvard University's Nima Arkani-Hamed.

Stone-cold genius

In 1997, Maldacena was contemplating a stubborn paradox having to do with black holes. Stephen Hawking of the University of Cambridge in England had long ago calculated that black holes would slowly evaporate, eventually disappearing in a burst of gamma rays. Apparently, no record would survive of the shape, size, or history of all the stuff that had fallen into a black hole.

But quantum mechanics does not allow information to be erased from the universe. Physical processes leave traces that could in principle be reversed to reconstruct the past, if accepted principles of

quantum theory are correct. But perhaps, Hawking and others suggested, ordinary quantum theory breaks down inside a black hole.

Maldacena attacked the paradox using string theory. But instead of using the extra elbow room afforded by six additional dimensions, he took the opposite approach, suggesting that gravitational phenomena in a stringy universe—including black holes—can have a representation in terms of particles.

So if the quantum physics of particles—where nothing can destroy information—can completely encapsulate the physics of black holes, then a black hole cannot destroy information either. There would have to be some other explanation for Hawking's paradox, but at least the foundations of quantum theory should be safe.

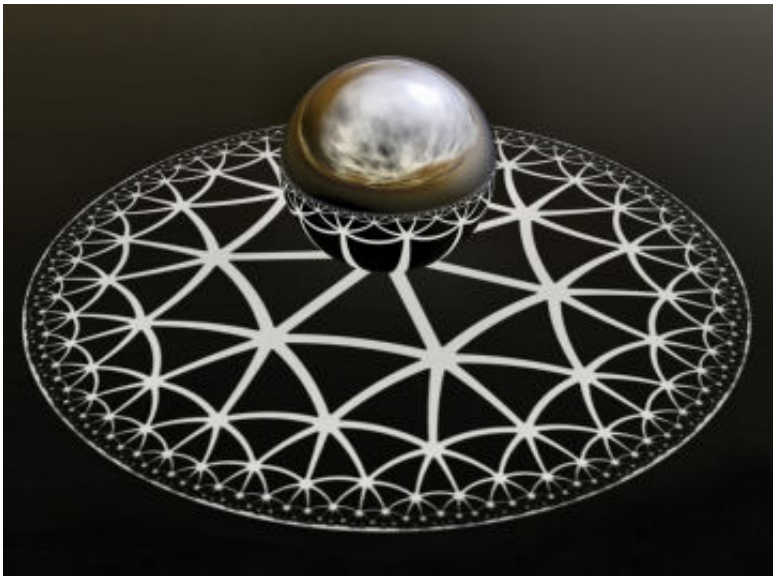
In 2004 , spurred in part by Maldacena's work, Hawking admitted that he had changed his mind, and stated that black holes probably don't destroy information after all (SN: 9/25/04, p. 202).

Maldacena first posted his proposal online in November 1997, barely a year after earning his Ph.D. degree at Princeton University. Within a few weeks, some of the leading string theory experts, including Edward Witten of the Institute for Advanced Study and Igor Klebanov of Princeton University, helped write a more explicit dictionary for Maldacena's duality. By the following June, when physicists met for a string theory conference in Santa Barbara, Calif., many were already unraveling the implications of Maldacena's idea.

At the meeting's banquet, physicists sang and danced to a song entitled "The Maldacena," a spoof of the then-popular "Macarena." "In some ways, it really took over the field," Klebanov says of the conjecture, which another leading researcher calls the work of a "stone-cold genius."

The sky's the limit

Since 1997, physicists have proposed countless variations on Maldacena's theme, all of which interpret a string as a swarm of particles living in a small number of dimensions. Perhaps the easiest case to visualize is when that number is two. In such a scenario, anything that takes place in your many-dimensional, stringy universe has a sort of shadow representation in terms of particles moving on that universe's "sphere at infinity." This esoteric-sounding concept is actually similar to the familiar celestial sphere of the night sky as seen from Earth: It's the two-dimensional surface spanning all possible directions one can point to infinitely far in space.



YOU'RE JUST PROJECTING. Universes with different physical laws and even different numbers of dimensions could have an underlying mathematical equivalence, much as a single pattern in this artist's impression looks different when projected onto surfaces with different geometries.
A. Sandberg

But on the face of it, neither of the universes involved in the duality has anything even remotely to do with the actual physical world. At one end of the duality are particles living in, say, two dimensions. The physics they obey, called conformal field theory, is vaguely similar to the physics of quarks, but not quite the same. The strong nuclear force between real quarks actually gets relatively weak when the quarks get extremely close to each other. But in conformal field theory, forces are the same at any distance.

At the other end is a stringy universe that has an eternal tendency to contract (even though it doesn't get any smaller because it's infinitely large to begin with). That's quite the opposite from the universe in which we live, which seems to contain a sort of antigravity called dark energy that makes the universe expand at an accelerating pace (SN: 1/3/98, p. 4).

Unfortunately, the equations of conformal field theory seem a good match only for the mathematics of strings living in a contracting universe. Still, many physicists remain hopeful that they will find an appropriate version of the duality that will do the trick for a universe like ours. If proved true, such a correspondence would offer a road map for building a complete string theory for the laws of nature.

Aside from the need to find a way of testing their ideas with experiments, string theorists' ultimate goal is to reconcile Einstein's theory of gravity with quantum physics. Gravity is the only fundamental force of nature that hasn't been "quantized," or subjected to the weird rules of quantum theory. As Arkani-Hamed puts it, if we lived in an eternally contracting universe, "the problem of quantizing gravity would have been solved."

Soon after Maldacena's first proposal, physicists realized that his duality could already shed light on the real world. For example, physicists believe that Maldacena's arguments on black holes, while formulated for the black holes of a contracting universe, are probably also relevant to black holes living in a universe like ours. In that case, a problem that seemed intractable on the strings side became much easier on the particles side. But the converse can also happen.

Black hole near New York!

When physicists smash heavy atomic nuclei together with sufficient energy, the atoms' protons and neutrons break up. For less than a sextillion of a second they melt into a blob called a quark-gluon plasma. It's similar to the state of all matter in the first microseconds after the big bang.

Beginning in 2000, Dam Son, now at the University of Washington in Seattle, and his collaborators wanted to calculate a quark-gluon plasma's viscosity—roughly speaking, a measure of how quickly the plasma will dampen turbulence within it. In principle, one should be able to do such calculations using the known equations of particle physics. When quarks are not bound together, though, those equations become extremely hard to solve.

But in a quark-gluon plasma, quarks will experience extremely intense forces, whose strength does not vary appreciably as the particles move. That makes the plasma's behavior a good approximation of the conformal field theory that rules Maldacena's sphere at infinity. Starting from that assumption, Son showed that Maldacena's duality translates the physics of plasma turbulence into that of black hole earthquakes.

A gravitational disturbance, Son says, will alter a black hole's shape, which is otherwise that of a perfect sphere. In response, the black hole will "oscillate, radiate energy, and settle down to be

spherical again." Son and his collaborators calculated how quickly the seismic waves on the black hole's surface will dampen down. Translated back, the calculation suggested that the viscosity of a quark-gluon plasma could be much smaller than physicists thought possible.

Initially, some nuclear physicists were nonplussed, to say the least, about the idea of doing nuclear physics using black holes. "The first time I heard about it, I literally thought it was crazy," says William Zajc of Columbia University in New York City.

In 2005, however, physicists at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory in Upton, N.Y., announced the results of an experiment that collided nuclei of gold atoms, melting them into a quark-gluon plasma (SN: 4/23/05, p. 259). The stuff's viscosity seemed close to Son's prediction, says Larry McLerran, a RHIC (pronounced "rick") experimentalist.

Many physicists working at RHIC—Zajc being one of them—changed their minds about Son's calculation. "It's far more useful than we ever imagined," he says. "The fact that it was done in some higher-dimensional space and it involved black holes—well, that just added to the intrigue."

Since then, some of the RHIC physicists have revisited certain theoretical assumptions used to interpret the experiment's data. As a result, some say it's no longer so clear that the viscosity is as low as Son claimed it could be. Not everyone buys the black hole model of a quark-gluon plasma. "It's certainly interesting, but you have to be very skeptical about it," he says.

More recently, Subir Sachdev of Harvard University and his team have extended Son's ideas to study transitions between certain exotic—but real—states of matter. As Sachdev and coauthors describe in the October *Physical Review B*, the team applied its new methods to the motion of electrons inside a superconductor when the temperature goes up just enough that the material becomes an electrical insulator. Instead of estimating viscosity, as Son did, the researchers calculated how long it will take for vortices of electrons to stop whirling. In their case, Sachdev says, the relevant dual phenomenon was the damping of electromagnetic disturbances that ensue when a photon falls into a black hole.

Ariadne's thread

The power of the string—particle duality, Maldacena says, lies in the fact that one can frame a problem in whichever mathematical language makes it easier to solve.

Calculations about particles are more manageable when the particles interact weakly. But the duality translates strongly interacting particles into weakly interacting strings. "When one of the descriptions becomes hard, the other one becomes easy, and vice versa," Maldacena says.

At least that is the prevailing belief, even though it has not been rigorously proved. In all cases in which physicists have been able to calculate two dual quantities independently, they got the same result, which is encouraging. But until recently, in all those examples the interaction strengths were at the extremes—infinitesimally small or infinitely large.

In the past 2 years, Niklas Beisert, now at Princeton University, and his collaborators have found the first examples that work at all possible interaction strengths. "If this was the theory of the real world, we would in some sense describe the mass of the proton and of all other composite particles," he says. What they found is that the two theories make the same predictions for those values. The calculations have created a kind of Ariadne's thread that can be followed from one theory to the other.

"The work they did is really wonderful," Maldacena says. "It's an incredible test" for Maldacena's conjecture, says Klebanov, who recently helped corroborate the results with numerical calculations. Still, the conjecture "certainly hasn't been proven in mathematical terms," Beisert warns. However, most experts now say they are virtually sure that it eventually will be.

But even if Maldacena's conjecture is true, does it mean that string theory is correct? Most string theorists would bet on it. It would be too much of a coincidence, they say, if such a seemingly miraculous mathematical duality were to apply to a particular kind of abstract universe but not to our own. "I believe that nature uses the same small set of ideas over and over," says Joseph Polchinski of the Kavli Institute for Theoretical Physics at the University of California, Santa Barbara.

Others are not so sure, and point out that there have been times in history when physicists have promoted hypotheses on the basis of their aesthetic appeal, only to be contradicted by the experimental evidence. A classic example, says Abhay Ashtekar of Pennsylvania State University in University Park, is Lord Kelvin's idea of vortices. In the 1860s, Kelvin pointed out that many of the known properties of chemical elements could arise naturally if atoms were knotted vortices in the fabric of the ether. The uncanny coincidence went away once physicists demonstrated that the ether probably didn't exist.

For now, Maldacena's duality ideas have become an engine for motivating and inspiring string theory research. "It's been a very good run," Klebanov says. "But we're still just kind of scratching the surface."

http://www.sciencenews.org/articles/20071117/bob9.asp

A Video That's Worth a Million Words

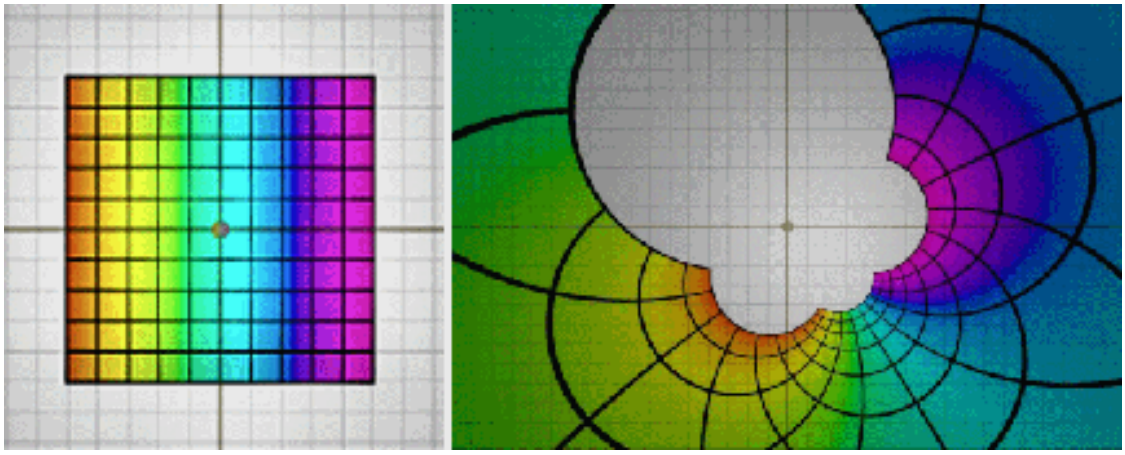
Award-winning video reveals the simplicity and beauty of an abstract mathematical tool

Julie J. Rehmeyer

Abstraction lies at the heart of mathematics. It makes math powerful, but at the same time, it can make math hard to understand. Abstraction makes math simultaneously beautiful and austere, useful and esoteric.

But a picture can tame the mad monster of abstraction, and sometimes, a video can do so even better. Now, a pair of mathematicians has created a video (see http://www.youtube.com/watch?v=JX3VmDgiFnY) that shows how to visualize and understand Möbius transformations, which are a fundamental and highly abstract mathematical tool. The new video, "Möbius Transformations Revealed," has become an Internet sensation, with 60,000 hits on YouTube so far. It also won honorable mention in the *Science* 2007 Science and Engineering Visualization challenge.

A Möbius transformation begins with a plane and moves each point to a new location according to certain rules. In their video, Douglas N. Arnold and Jonathan Rogness of the University of Minnesota in Minneapolis transform a multicolored square into new shapes using Möbius transformations.



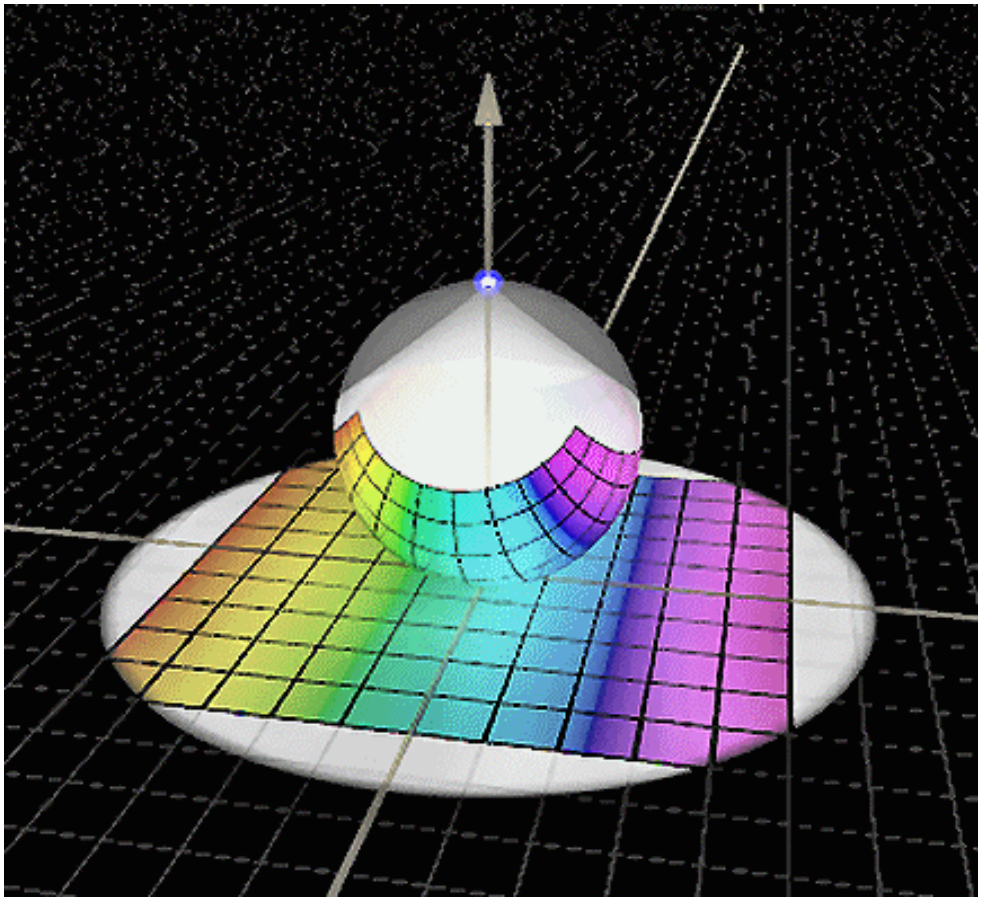
A Möbius transformation can turn the square on the left into the bizarre form on the right. Click here or on the image to see a video that shows how the transformation works.

Arnold and Rogness

A Möbius transformation alters an entire plane. To understand the transformation, it helps to focus on a square that lies on the plane. A Möbius transformation can alter the square in any of four ways. The first three ways aren't too hard to picture: the transformation can move a square around on the plane, expand or contract the square, or rotate it.

The fourth alteration is especially intriguing. A Möbius transformation can turn the square inside out. The Arnold-Rogness video illustrates this process beautifully, showing how points that start close to the square's center are sent far outward, while points near the edge of the square move toward the center.

Next comes the video's magical step. The mathematicians move into the third dimension to provide a way of visualizing the Möbius transformations. They suspend a sphere above the plane and use it a bit like a slide projector. They put a picture onto the sphere, and a light at the top of the sphere shoots an image of the picture down onto the plane. The picture on the sphere is shaped in such a way that when the light projects the image onto the plane, it forms the original square.



A light at the top of the sphere projects an image of the square down onto the plane.
Arnold and Rogness

Now imagine moving the sphere while continuing to shine the light from its top. The "slide projection system" will change the image on the plane, producing a Möbius transformation of the image. Move the sphere a bit to the left, and the projected square will move the left. Move the sphere up, and the square will expand. Rotate the sphere around its vertical axis, and the square will also rotate.

If you turn the sphere upside down but keep the light in the same spot above the plane, the square will turn inside out! This is the puzzling "inside-out" transformation.

"You need some pretty heavy mathematical machinery that people usually don't do until their first year of grad school to prove the stuff in the video," Rogness says, "but we've been showing this to high school students and they seem to get it."

Rogness and Arnold had both heard that Möbius transformations could be visualized in this way, but when they began working on the video, they realized that they had never seen a proof that the method

works. They hunted through textbooks and could not find a reference to the proof, even though all the mathematicians they talked to knew it to be true. Finally, they sat down and proved it themselves.

"It's a folk theorem," Rogness says. "Everyone seems to know it but I'm still not sure when it was first proven or by whom."

The duo has been astonished by the video's popularity. "I put up the YouTube version just so that we could mention it to friends and fellow mathematicians, expecting a few hundred people might watch it," Rogness says. After the video was mentioned on the technology website Slashdot, about 20,000 people viewed it overnight, and the numbers have continued to increase ever since, Rogness says with amazement. "It's been many orders of magnitude more than I expected."

http://www.sciencenews.org/articles/20071117/mathtrek.asp

Canadians Advocate Boosting Vitamin D in Pregnancy

A Canadian medical society recommends pregnant women and nursing moms boost their intake of vitamin D dramatically

Janet Raloff

Canadian pediatricians certainly aren't shirking controversy when it comes to a vitamin guideline they've developed for pregnant women and nursing moms. They're asking these women to boost their intake of vitamin D dramatically—to 10 times the daily doses advocated by most health organizations in the States. This new prescription is aimed at combating rickets—leg deformations caused by soft bones—in youngsters who get too little of the sunshine vitamin.

Vitamin D helps build strong bones by helping the body absorb calcium. Getting pregnant and nursing women to take more of the vitamin ensures that plenty will reach developing children.

In the past, most people had little trouble getting enough vitamin D—they just went outdoors where ultraviolet rays from the sun trigger chemical reactions in skin to make this vital nutrient. However, some people always had trouble making enough. Canadian kids at highest risk of vitamin deficits generally live in First Nations and Inuit communities. With sun-filtering pigments in their skin, and living at high latitudes, they must glean most of their vitamin D from the diet—generally a poor source—not the sun.

EATING FOR TWO. To ensure baby's bones are strong, moms-to-be should boost their vitamin-D intake greatly, Canadian pediatricians contend. Photodisc

Most North American women—including those in the United States—eat diets delivering only about 100 international units, or IU, of vitamin D daily, according to the Institute of Medicine (IOM), in Washington, D.C. That is half of what IOM recommends and a mere 5 percent of what Canadian pediatricians are now advocating for new and soon-to-be moms.

Although IOM's dietary recommendations are for the United States, the Canadian health establishment has tended to rubber stamp them. In this case, though, Canada's health agency took the unusual tack of signing off on a Canadian Paediatric Society proposal to boost the recommended intake by women who are pregnant or breast feeding to 2,000 IU per day. This new guideline appears in a consensus statement published in September by the society in its journal, *Paediatrics & Child Health*.

Soon the society will begin sending its new guideline to every provincial, territorial, and aboriginal health department across Canada, notes Marie Adèle Davis, the group's executive director. The goal, she told *Science News Online*, is to make sure all public health officials learn about it—not just pediatricians.

The higher recommendation equals the amount that IOM has designated as the safe upper limit for vitamin D's daily consumption. Most nutritionists don't really consider that value is a true ceiling for safe intake—especially since sunbathing on a bright summer day can generate 10,000 to 20,000 IU in

the body without harm. Still, for political and legal reasons, most organizations shy away from advocating intakes near what IOM has flagged as a potential maximum for safe consumption.

Now a number of researchers suspect that intakes by pregnant and lactating women much below 2,000 IU per day could actually prove unsafe for child health.

Reinhold Vieth of the University of Toronto explained why, recently, to officials with Health Canada, a counterpart to the U.S. Food and Drug Administration. To prevent rickets, he argued, a baby needs 400 IU of vitamin D per day. And in many parts of Canada, he said, nursing women may require several thousand IU of vitamin D per day to get 400 IU into their breast milk. Vieth had been recruited by the Canadian Paediatric Society to help defend its proposed guideline to government officials.

U.S. physicians won't quibble over the 400 IU figure for babies and young children, notes pediatrician Frank R. Greer, chair of the American Academy of Pediatrics' (AAP) committee on nutrition. Although the 1997 IOM report says 200 IU of vitamin D per day should be sufficient for anyone under 50—including children—few researchers buy that. "Everybody feels that we should be taking more than 200 IU," says Greer, of the University of Wisconsin–Madison.

Unlike the Canadian Paediatric Society, though, "We [at AAP] don't really have any influence on what pregnant and lactating women take," Greer says. "However, I can say that AAP's committee on nutrition has recommended to the board that we go back to [recommending] 400 IU for all children." That's the amount in a teaspoon of cod liver oil—the vitamin D supplement of choice throughout the early 20th century. Greer expects his committee's recommendation to be approved by AAP's board, perhaps within the next month.

Optimal needs vary

For most of the past century, nutrient guidelines have been set to prevent gross deficiencies—shortfalls that could cause disease. Those recommendations tended to represent minimally adequate intakes. Over the past decade, however, considerable debate has surrounded what vitamin D consumption levels would be optimal versus merely adequate.

The controversy has been fueled by a steady stream of studies that have emerged since the IOM set its vitamin D guidelines. Nearly all demonstrate substantial health benefits from relatively high intakes of vitamin D—amounts well in excess of what most individuals now get. Moreover, those benefits extend well beyond protecting bone. More vitamin D seems to diminish the risk of cancer, diabetes, autoimmune disorders, muscle loss, viral infections—even gum disease.

Researchers gauge vitamin D sufficiency on the basis of 25-hydroxy vitamin D (25-HD). This is not the form of the vitamin that is consumed—nor the hormonal form that the body actually uses—but an intermediary. To achieve optimal concentrations of 25-HD, growing numbers of nutrition and health scientists suggest, most of us would need intakes of 800 to 4,000 IU per day (see **Vitamin D: What's Enough?**).

How much vitamin D someone needs can vary widely, largely depending on the amount of skin that gets exposed to the sun each day—and for how long. Further complicating the picture, some skin is heavily pigmented, filtering sunlight out. Many people cover up with clothes or sunblock when they go outdoors. Still others live at high latitudes—as Canadians do—where little ultraviolet radiation makes it through the atmosphere during much of the year.

Even for women in the southern United States, however, "we've found that lactating women need about 6,000 IU a day to transfer enough vitamin D into their milk to supply adequate amounts to a nursing infant," says Bruce W. Hollis of the Medical University of South Carolina in Charleston.

Nor are nursing moms the only individuals who may need relatively large doses of the vitamin. Hollis' research has shown that black women may sometimes need 4,000 IU a day for months at a time to

compensate for little time outdoors, heavy skin pigmentation, and/or obesity—a factor that appears to diminish the body's ability to use vitamin D efficiently (see **Understanding Vitamin D Deficiency**).

Another reason for moms' supplementation?

In March, researchers at Harvard Medical School reported evidence that ample vitamin D diminishes the chance a child will develop asthma, a scourge who's incidence has been rising, especially in black and low-income communities (see **Childhood Vitamin D—A New Benefit?**). Recently, an additional putative benefit has emerged for pregnant women and their developing babies.

A study linked elevated risk of preeclampsia—high blood pressure that develops in some women during the last half of pregnancy—with low intakes of vitamin D. This condition, which can lead to miscarriage and even the death of the mother—ordinarily develops in some three to seven percent of first pregnancies.

Pittsburgh researchers enrolled 1,198 women who were pregnant for the first time and measured their blood concentrations of vitamin D within the first 22 weeks of gestation. Subsequently, 59 women developed preeclampsia. Blood values from all but four were compared to a similar group of recruits who maintained normal blood pressure throughout their pregnancies.

The higher a woman's blood concentrations of 25-HD, the lower her chance of developing preeclampsia—and that risk fell steadily and "strikingly" with increasing vitamin D values, Lisa M. Bodnar of the University of Pittsburgh and her colleagues found.

Moreover, babies whose moms had developed preeclampsia were far more likely to have low vitamin-D values than were children whose moms had maintained normal blood pressure. "These differences were found in our population despite widespread prenatal/multivitamin use in the 3 months before delivery," Bodnar's group reports in the September *Journal of Clinical Endocrinology and Metabolism.*

Black women face far higher risks of developing this hypertensive syndrome. Overall, black women are also far likelier than other ethnic or racial groups to have low blood levels of vitamin D. Against this backdrop, Bodnar's group says, "our data linking vitamin D deficiency and preeclampsia risk raises the intriguing possibility that vitamin D may contribute to racial disparities in this [syndrome]."

"The story of deficiency begins with vitamin D itself and its primary mode of synthesis, which is from sunlight," argue Adekunle Dawodu of the University of Cincinnati and Carol L. Wagner of the Medical University of South Carolina in Charleston. In a commentary in the September *Archives of Disease in Childhood*, they report a resurgence of rickets around the world, not only in children at high latitudes, but also in the Arab world and Asia where culture or excessive temperatures may keep women and children indoors or covered up.

A shift from vitamin-D sufficiency to widespread deficiency has occurred rapidly—mostly throughout a half-century. The reason for it is clear, Dawodu and Wagner say: "insufficient sun exposure and inadequate corrective vitamin-D supplementation." They conclude, much as the Canadian Paediatric Society just has, that dosing moms during pregnancy and lactation "would achieve the double effect of preventing vitamin-D deficiency in both mothers and children." But unlike the Canadian society, they note that doses considerably higher than 2,000 IU may be necessary for some individuals and communities.

As a goal, achieving population-wide vitamin D sufficiency "may be one of the more important preventative public health initiatives," conclude Dawodu and Wagner.

http://www.sciencenews.org/articles/20071117/food.asp

Oceans Could Slurp Up Carbon Dioxide To Fight Global Warming

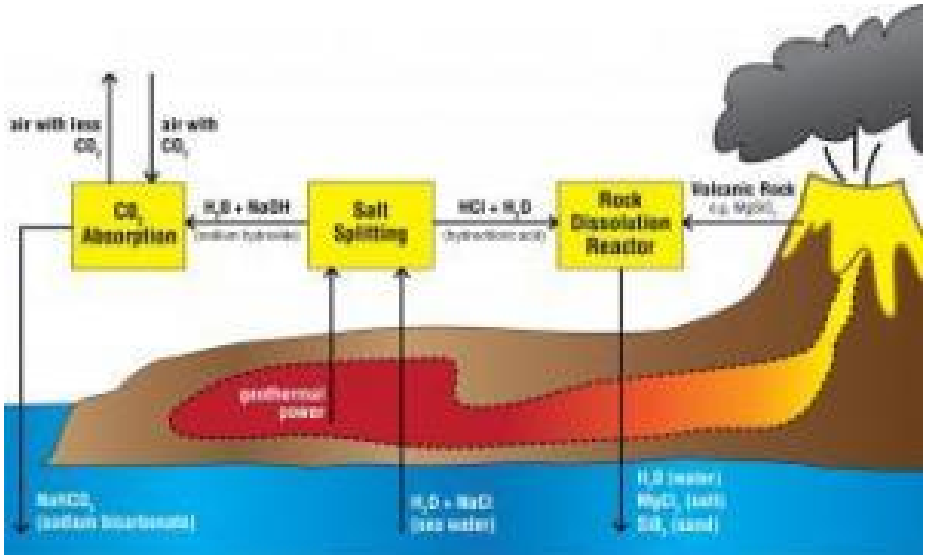


Illustration depicts how the oceans could be used as a giant carbon dioxide collector to fight global warming. (Credit: Courtesy of Kurt House, Harvard University)

ScienceDaily (Nov. 20, 2007) — Researchers in Massachusetts and Pennsylvania are proposing a new method for reducing global warming that involves building a series of water treatment plants that enhance the ability of the ocean to absorb carbon dioxide from the atmosphere.

About 100 such plants -- which essentially use the ocean as "a giant carbon dioxide collector" -- could cause a 15 percent reduction in emissions over many years, they say. About 700 plants could offset all CO_2 emissions.

Scientists believe that excessive build-up of carbon dioxide in the air contributes to global warming. In addition to cutting down on carbon dioxide emissions by reducing the use of fossil fuels, researchers have focused on new technologies that remove the gas directly from the atmosphere.

In the new study, Kurt Zenz House and colleagues propose building hundreds of special water treatment facilities worldwide that would remove hydrochloric acid from the ocean by electrolysis and neutralize the acid through reactions with silicate minerals or rocks.

The reaction increases the alkalinity of the ocean and its ability to absorb carbon dioxide from the atmosphere. The process is similar to the natural weathering reactions that occur among silicate rocks but works at a much faster rate, the researchers say.

The journal article, "Electrochemical Acceleration of Chemical Weathering as an Energetically Feasible Approach to Mitigating Anthropogenic Climate Change," is scheduled to appear in the Dec. 15 issue of ACS' Environmental Science & Technology.

Adapted from materials provided by American Chemical Society.

http://www.sciencedaily.com/releases/2007/11/071119112231.htm

Earliest Chocolate Drink Of The New World

Bottle from an unidentified site in northern Honduras corresponding to a type produced between 1400 and 1100 BC at Puerto Escondido. Barraca Brown Burnished type (Ocotillo phase, 1100-900 BC). Collection of the Instituto Hondureño de Antropología e Historia, Museo de San Pedro Sula, Honduras. (Credit: Drawing courtesy of Yolanda Tovar)

ScienceDaily (Nov. 20, 2007) — The earliest known use of cacao—the source of our modern day chocolate—has been pushed back more than 500 years, to somewhere between 1400 and 1100 B.C.E., thanks to new chemical analyses of residues extracted from pottery excavated at an archaeological site at Puerto Escondido in Honduras. The new evidence also indicates that, long before the flavor of the cacao seed (or bean) became popular, it was the sweet pulp of the chocolate fruit, used in making a fermented (5% alcohol) beverage, which first drew attention to the plant in the Americas.

That cacao's popularity on the world stage began with its role in an alcoholic beverage does not surprise the researchers.

"This development probably provided the impetus to domesticate the chocolate tree and only later, to prepare a beverage based on the more bitter beans," suggested Dr. Patrick McGovern* of the University of Pennsylvania Museum of Archaeology and Anthropology. "An alcoholic beverage from the pulp, carrying on this ancient tradition, continues to be made in parts of Latin America."

The famous chocolate beverage of the Mayan and Aztec kings, served at special ceremonies and feasts, came later. It was made from the cacao beans, often mixed with chillis, special herbs, honey, and flowers. The liquid was frothed into a foam, and both inhaled and drunk.

Throughout his career, Dr. McGovern has worked on techniques to determine what food and, more often, drink, once filled the ancient pottery and other food vessels that archaeologists find throughout the world—shedding new light on the gastronomic and cultural story of human civilization around the world. Time and again, he has seen that alcoholic beverages go hand in hand with the earliest development of human cultures. As with the cacao fruit in Central America, high-sugar fruits and honey were similarly used to produce alcoholic beverages in other parts of the world at an early date, including Neolithic China and the Near East, two regions where Dr. McGovern has played a role in the discovery of the earliest known beverages.**

"The beverages of China and the Near East also became the prerogative of the elite, and were incorporated into religious ceremonies and celebrations," he noted. "They were often of considerable economic value, just as the cacao bean was the medium of exchange in the Aztec empire, and they were traded, given in tribute, and offered as gifts to fellow rulers and the gods."

Though not part of the archaeological research team at Puerto Escondido in Honduras, Dr. McGovern got involved in the scientific research on this material after he read an article in the Fall 2001 issue of the Arts & Sciences Newsletter of his alma mater, Cornell University. Entitled "The Birth of Chocolate or, The Tree of the Food of the Gods," it was written by Cornell Anthropology Professor John S. Henderson, co-excavator, with University of California Berkeley Professor Rosemary A. Joyce, at the Honduras site. Dr. Henderson had graduated in 1967, a year after McGovern, yet their paths had never crossed.

Dr. McGovern read in the article that Dr. Henderson was looking for a way to extract the ancient residues of a liquid from the pores of the vessels.

"I sent an email to John, suggesting that our Penn Museum laboratory, where I work with Gretchen Hall, Research Associate, probably had the tools available to find out what the ancient vessels held. From there, he negotiated to have a collection of sherds from vessels of types believed to have held liquid, and the Penn Museum and Hershey Foods Technical Center labs carried out extractions and analyses."

"The results were astounding–-every vessel that he had chosen and was tested gave a positive signal for theobromine, the fingerprint compound for cacao in Central America."

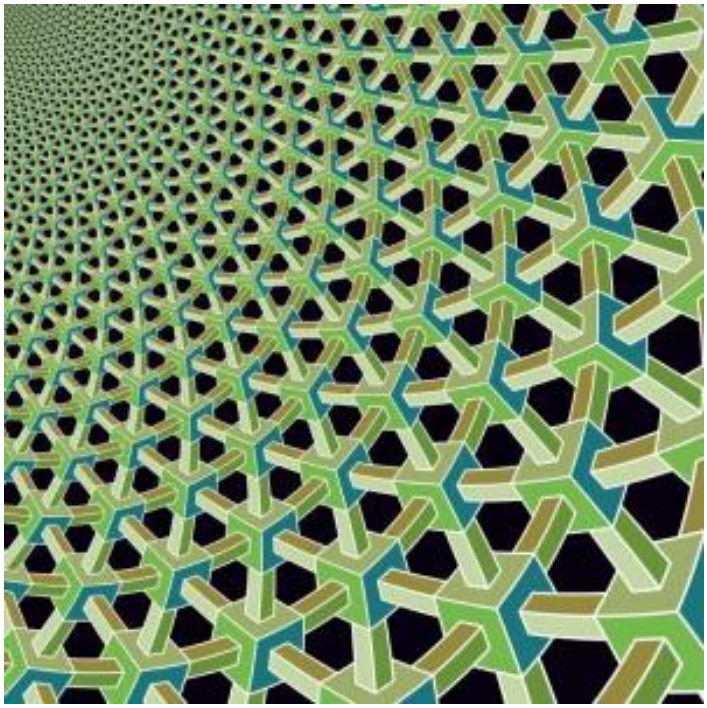
* Archaeochemist Dr. Patrick McGovern, Senior Research Scientist, Museum Applied Science Center for Archaeology (MASCA) at the University of Pennsylvania Museum of Archaeology and Anthropology was one of five authors of the scientific research article on the discovery ("Chemical and archaeological evidence for the earliest cacao beverages," by John S. Henderson, Rosemary A. Joyce, Gretchen R. Hall, W. Jeffrey Hurst, and Patrick E. McGovern) to be published on-line in Early Edition the week of Nov. 12 and in the November 27, 2007 print issue of PNAS USA (pp. 18937-18940, Issue 48, Volume 104).

**See also Ancient Wine, Princeton University Press, 2003/2006, and "Fermented Beverages of Pre- and Proto-Historic China," Proceedings of the National Academy of Sciences USA 101.51: 17593-98.

Adapted from materials provided by University of Pennsylvania.

http://www.sciencedaily.com/releases/2007/11/071119103540.htm

How Do We Make Sense Of What We See?



Escher style Fractal - Connected Cubes. (Credit: iStockphoto)

ScienceDaily (Nov. 20, 2007) — M.C. Escher's ambiguous drawings transfix us: Are those black birds flying against a white sky or white birds soaring out of a black sky? Which side is up on those crazy staircases?

Lines in Escher's drawings can seem to be part of either of two different shapes. How does our brain decide which of those shapes to "see?" In a situation where the visual information provided is ambiguous — whether we are looking at Escher's art or looking at, say, a forest — how do our brains settle on just one interpretation?

In a study published this month in Nature Neuroscience, researchers at The Johns Hopkins University demonstrate that brains do so by way of a mechanism in a region of the visual cortex called V2.

That mechanism, the researchers say, identifies "figure" and "background" regions of an image, provides a structure for paying attention to only one of those two regions at a time and assigns shapes to the collections of foreground "figure" lines that we see.

"What we found is that V2 generates a foreground-background map for each image registered by the eyes," said Rudiger von der Heydt, a neuroscientist, professor in the university's Zanvyl Krieger Mind/Brain Institute and lead author on the paper. "Contours are assigned to the foreground regions, and V2 does this automatically within a tenth of a second."

The study was based on recordings of the activity of nerve cells in the V2 region in the brain of macaques, whose visual systems are much like that of humans. V2 is roughly the size of a microcassette and is located in the very back of the brain. Von der Heydt said the foreground-background "map" generated by V2 also provides the structure for conscious perception in humans.

"Because of their complexity, images of natural scenes generally have many possible interpretations, not just two, like in Escher's drawings," he said. "In most cases, they contain a variety of cues that could be used to identify fore- and background, but oftentimes, these cues contradict each other. The

V2 mechanism combines these cues efficiently and provides us immediately with a rough sketch of the scene."

Von der Heydt called the mechanism "primitive" but generally reliable. It can also, he said, be overridden by decision of the conscious mind.

"Our experiments show that the brain can also command the V2 mechanism to interpret the image in another way," he said. "This explains why, in Escher's drawings, we can switch deliberately" to see either the white birds or the dark birds, or to see either side of the staircase as facing "up."

The mechanism revealed by this study is part of a system that enables us to search for objects in cluttered scenes, so we can attend to the object of our choice and even reach out and grasp it.

"We can do all of this without effort, thanks to a neural machine that generates visual object representations in the brain," von der Heydt said. "Better yet, we can access these representations in the way we need for each specific task. Unfortunately, how this machine' works is still a mystery to us. But discovering this mechanism that so efficiently links our attention to figure-ground organization is a step toward understanding this amazing machine."

Understanding how this brain function works is more than just interesting: It also could assist researchers in unraveling the causes of — and perhaps identifying treatment for — visual disorders such as dyslexia.

Other authors include Fangtu T. Qiu and Tadashi Sugihara, both of the Zanvyl Krieger Mind-Brain Institute. Funding for the research was provided by the National Institutes of Health.

Adapted from materials provided by Johns Hopkins University.

http://www.sciencedaily.com/releases/2007/11/071119123926.htm

Maya Politics Likely Played Role In Ancient Large-game Decline

Florida Museum of Natural History Environmental Archeology Assistant Curator Katherine Emery displays bones used in her research documenting ancient hunting effects on large-game species in the Maya lowlands of Central America. Emery's study shows political and social demands near important cities likely contributed to population declines in large species, especially white-tailed deer. (Credit: (Eric Zamora/Florida Museum of Natural History))

ScienceDaily (Nov. 20, 2007) — A University of Florida study is the first to document ancient hunting effects on large-game species in the Maya lowlands of Central America, and shows political and social demands near important cities likely contributed to their population decline, especially white-tailed deer.

Additional evidence from Maya culture and social structure at the end of the Classic period (approximately 250 to 800 A.D) strongly supports this assertion.

“We’re finding declines specifically in large-game species, and particularly in the species that were politically and socially important to the Maya,” Emery said. “The politically powerful elite Maya had preferential access to large game, and white-tailed deer were especially important to the Maya as food and for their symbolic power.”

Emery tracked the proportion of large-game animals to all vertebrate species over time, using 78,928 animal bones found at 25 Maya archaeological sites. To tease apart specific hunting effects, she also tracked the proportion of white-tailed deer to all vertebrates. Her samples spanned 2,500 years, from about 1000 B.C. to 1500 A.D.

This period includes the collapse of the lowland Maya political and social order and the final period of Spanish colonization. Her study, funded by the National Science Foundation, is the first regional analysis of this area to interpret how humans impacted animal populations based on archaeological data of animal use by humans. She used both her own original data and existing published data.

"The data suggests the game decline was caused primarily by hunting pressure since the reduction in numbers was recorded for large vertebrates as opposed to just animals sensitive to the disappearance of forest cover or those sensitive to climate changes," Emery said. "But the effects of hunting pressure were undoubtedly exacerbated by deforestation and climate change since there is also documented evidence for these changes at the same time."

Emery said not all sites showed large-game declines despite high human population, and that the declines were most noticeable at regional capitals and large cities.

"The capital cities were home to a large and top-heavy ruling class who demanded that the regions' hunters provide them with large quantities of the best cuts of favorite meats from large game, and particularly the white-tailed deer," Emery said. "They also demanded large numbers of symbolically important species such as white-tailed deer and large wild cats like jaguar and puma, since these species were used as symbolic displays of their wealth and power, and were used in ritual interactions with the deities."

Deer also were important theatrically because actors wore costumes to portray the predator-prey relationship.

The power of the noble classes and the king was based on their perceived abilities to control ecology, but Emery said several negative environmental situations converged simultaneously, likely contributing to the collapse of Maya political stability starting around 1,200 years ago. According to current Maya archaeological theory, Maya demand for wood used in building finishes such as lime plaster combined with an exploding population base that cleared more and more land for agriculture — resulting in deforestation. Concurrent climate change resulted in a 200-year drought which further curtailed forest regrowth.

"The rulers' response to the environmental degradation may have been to demand more large game and more deer to use in feasts and rituals where they appealed to deities for help and also to prove their status," Emery said. "As the valued resources became more scarce, they made more demands to obtain them to prove and reinforce their power."

Their demand for large game was not extreme enough to cause extinction or local exterminations, an important finding. Emery said this indicates that over the 2,500 years of this study, the ancient Maya were generally careful of their animal resources.

Brown University ancient Maya scholar Stephen Houston said Emery's "breadth of expertise" allowed her to tackle such an important review of Maya animal use.

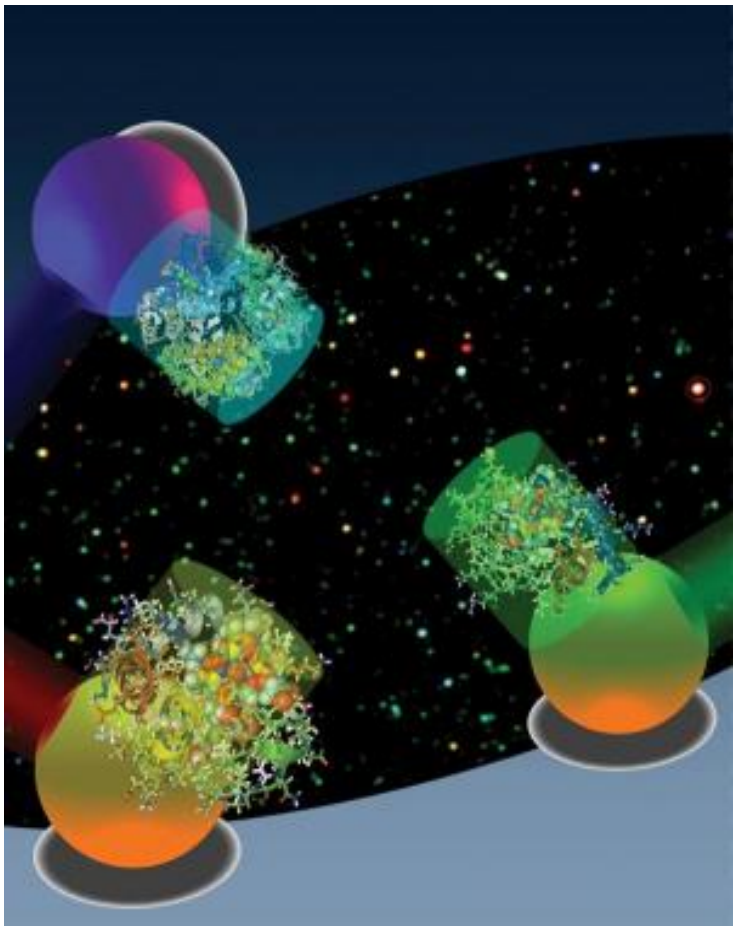
"The lack of extinctions shows that the Maya impact on parts of their environment was not as profound as some have thought," Houston said. "That is, we don't see utter devastation to the extent that species disappeared entirely. But Emery also confirms that the Maya went after high-value, prestigious meats like deer and, through vigorous hunting, that they found such game harder and harder to find."

The study by Florida Museum of Natural History Assistant Curator of Environmental Archaeology Kitty Emery appears in the Oct. 31 issue of the Journal for Nature Conservation.

Adapted from materials provided by University of Florida.

http://www.sciencedaily.com/releases/2007/11/071114200920.htm

New Nanoparticle Technique Captures Chemical Reactions In Single Living Cell With Amazing Clarity



Lights scatter from metallic nanoplasmonic particles upon excitation of an external light source. UC Berkeley researchers coupled the metallic nanoparticles with biomolecules to detect chemical signals within a single living cell at unprecedented resolution. (Credit: Graphic by Gang Logan Liu and Luke Lee/UC Berkeley)

ScienceDaily (Nov. 19, 2007) — Bioengineers at the University of California, Berkeley, have discovered a technique that for the first time enables the detection of biomolecules' dynamic reactions in a single living cell.

By taking advantage of the signature frequency by which organic and inorganic molecules absorb light, the team of researchers, led by Luke Lee, professor of bioengineering and director of UC Berkeley's Biomolecular Nanotechnology Center, can determine in real time whether specific enzymes are activated or particular genes are expressed, all with unprecedented resolution within a single living cell.

The technique could lead to a new era in molecular imaging with implications for cell-based drug discovery and biomedical diagnostics.

The researchers point out that other techniques, such as nuclear magnetic resonance, can at best provide information about a cluster of cells. But to determine the earliest signs of disease progression or of stem cell proliferation, it's necessary to drill down deeper to the molecular dynamics within a single cell.

To study the biochemical processes of a cell, scientists currently cut through its outer membrane to separate and analyze the cellular components. That method can never provide a real-time view of how components function together because the cell is killed in the process of extracting its components.

"Until now, there has been no non-invasive method that exists that can capture the chemical fingerprints of molecules with nanoscale spatial resolution within a single living cell," said Lee, who is also a faculty affiliate of the California Institute for Quantitative Biosciences and the co-director of the Berkeley Sensor and Actuator Center. "There is great hope that stem cells can one day be used to treat diseases, but one of the biggest challenges in this field is understanding exactly how individual cells differentiate. What is happening inside a stem cell as it develops into a heart muscle instead of a tooth or a strand of hair? To find out, we need to look at the telltale chemical signals involved as proteins and genes function together within a cell."

The researchers tackled this challenge by improving upon conventional optical absorption spectroscopy, a technique by which light is passed through a solution of molecules to determine which wavelengths are absorbed. Cytochrome c, for instance, is a protein involved in cell metabolism and cell death that has several optical absorption peaks of around 550 nanometers.

The absorption spectra of a molecule can change based upon the chemical changes that occur as it interacts with other molecules, such as oxygen.

"For conventional optical absorption spectroscopy to work, a relatively high concentration of biomolecules and a large volume of solution is needed in order to detect these subtle changes in frequencies and absorption peaks," said Lee. "That's because optical absorption signals from a single biomolecule are very weak, so you need to kill hundreds to millions of cells to fish out enough of the target molecule for detection."

The researchers came up with a novel solution to this problem by coupling biomolecules, the protein cytochrome c in this study, with tiny particles of gold measuring 20-30 nanometers long. The electrons on the surface of metal particles such as gold and silver are known to oscillate at specific frequencies in response to light, a phenomenon known as plasmon resonance. The resonant frequencies of the gold nanoparticles are much easier to detect than the weak optical signals of cytochrome c, giving the researchers an easier target.

Gold nanoparticles were chosen because they have a plasmon resonance wavelength ranging from 530 to 580 nanometers, corresponding to the absorption peak of cytochrome c.

"When the absorption peak of the biomolecule overlaps with the plasmon resonance frequency of the gold particle, you can see whether they are exchanging energy," said study co-lead author Gang Logan Liu, who conducted the research as a UC Berkeley Ph.D. student in bioengineering. "This energy transfer shows up as small dips, something we call 'quenching,' in the characteristic absorption peak of the gold particle."

A relatively small concentration of the molecule is needed to create these quenching dips, so instead of a concentration of millions of molecules, researchers can get by with hundreds or even dozens of molecules. The sensitivity and selectivity of the quenching dips will improve the molecular diagnosis of diseases and be instrumental in the development of personalized medicine, the researchers said.

The researchers repeated the experiment matching the protein hemoglobin with silver nanoparticles and achieved similar results.

"Our technique kills two birds with one stone," Lee said. "We're reducing the spatial resolution required to detect the molecule at the same time we're able to obtain chemical information about molecules while they are in a living cell. In a way, these gold particles are like 'nano-stars' because they illuminate the inner life of a cellular galaxy."

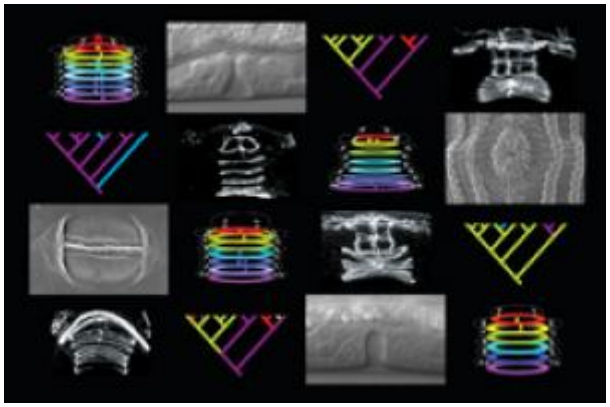
Other researchers on the UC Berkeley team are Yi-Tao Long, co-lead author and postdoctoral scholar in bioengineering; Yeonho Choi, a Ph.D. student in mechanical engineering; and Taewook Kang, a postdoctoral scholar in bioengineering.

This research is described in the Nov. 18 issue of the journal Nature Methods. The Ministry of Science and Technology in Korea helped support this research.

Adapted from materials provided by University of California - Berkeley.

http://www.sciencedaily.com/releases/2007/11/071119170147.htm

Evolution Is Deterministic, Not Random, Biologists Conclude From Multi-species Study



Variation of vulval development among rhabditid nematodes. (Credit: Image courtesy of New York University)

ScienceDaily (Nov. 19, 2007) — A multi-national team of biologists has concluded that developmental evolution is deterministic and orderly, rather than random, based on a study of different species of roundworms.

The researchers were interested in how development evolves in organs which themselves do not change. To do so, they examined the vulva -- the female's copulatory and egg-laying organ -- in nearly 50 species of roundworms. Because the vulva does not significantly change across species, one might predict that there would be little variation in vulva development. However, the researchers found an astonishing amount of developmental variation. They then reasoned that this variation, since it did not affect the final adult vulva, should have evolved in a stochastic, or random, fashion.

In executing the study, the research team analyzed more than 40 characteristics of vulva development, including cell death, cell division patterns, and related aspects of gonad development. They plotted the evolution of these traits on a new phylogenetic tree, which illustrates how species are related to one another and provides a map as to how evolutionary changes are occurring.

Their results showed an even greater number of evolutionary changes in vulva development than the researchers had expected. In addition, they found that evolutionary changes among these species were unidirectional in nearly all instances.

For example, they concluded that the number of cell divisions needed in vulva development declined over time -- instead of randomly increasing and decreasing. In addition, the team noted that the number of rings used to form the vulva consistently declined during the evolutionary process. These results demonstrate that, even where we might expect evolution to be random, it is not.

The leading author is Karin Kiontke, a post-doctoral fellow in New York University's Department of Biology. The research team included NYU Biology Professor David Fitch as well as researchers from the University of Paris, the Israel Institute of Technology, and the Max-Planck Institute for Developmental Biology in Germany.

The findings are reported in the latest issue of the journal Current Biology.

The study was supported, in part, by a grant from the National Science Foundation.

Adapted from materials provided by New York University.

http://www.sciencedaily.com/releases/2007/11/071119123929.htm

New Genetic Lineage Of Ebola Virus Discovered In Great Apes

Between 2001 and 2006, scientists studying Ebola epidemics discovered 47 animal carcasses in Gabon and the Republic of Congo. Among them were the remains of 18 gorillas and 5 chimpanzees. (Credit: iStockphoto/Michael Fernahl)

ScienceDaily (Nov. 19, 2007) — Since its discovery 30 years ago, Ebolavirus has struck repeatedly in several epidemics breaking out mainly in Central Africa. Gorillas and chimpanzees are also victims of the violent haemorrhagic fever attacks the virus triggers. With the aim of understanding more of Ebola's action mechanisms, scientists collect viral RNA samples from infected individuals at each outbreak.

Scientists have now succeeded in mapping virus sequences from samples taken from anthropoid apes. Analysis of this genetic material demonstrated the existence of a new lineage genetic of the Zaire species. It also revealed that genetic recombination events, processes extremely rare for this type of virus, would have taken place between 1996 and 2001.

The Zaire species of Ebolavirus (ZEBOV) remains the most virulent of the various known species. It alone is responsible for 88% of human deaths from haemorrhagic fever recorded since Ebola's discovery in 1976. It was moreover the species involved in the two-month long epidemic which raged in the Democratic Republic of Congo (DRC). In spite of the mass of scientific data collected during previous epidemics, the international scientific community has still not succeeded in determining the evolutionary development of the Ebolavirus and more particularly that of ZEBOV.

Investigations were restricted by the scarcity of available data. Only 12 gene sequences coding for the glycoprotein (GP), a molecular structure that enables the virus to penetrate a cell before infecting it, have currently been identified.

Furthermore, these sequences, isolated from infected humans between 1976 and 2001, appear to belong to a single genetic lineage originating from the first epidemic documented in the DRC in 1976. This apparent genetic uniformity therefore suggested that epidemics that broke out after 1976 all stemmed from the very first one. However, recent discoveries by a joint IRD-CIRMF team have called this hypothesis into question.

Between 2001 and 2006, these scientists discovered 47 animal carcasses in Gabon and the Republic of Congo. Among them were the remains of 18 gorillas and 5 chimpanzees. The rapid tissue decomposition of the carcasses meant that the search for RNA sequences coding for GP was conclusive for only 6 gorillas and one chimpanzee.

Nevertheless, phylogenetic analysis of these was able to show that the virus which had contaminated the seven primates belonged to a new genetic lineage of ZEBOV. This lineage, named B, showed 2 to 3% genetic divergence from lineage A, the one in which scientists had hitherto classified all the viruses gathered from infected humans. For the purposes of this study, the GP sequences of the viral strains responsible for human epidemics documented since 2001 were also put through phylogenetic analysis.

Up to 2003 this confirmed that the viral strains indeed belonged to lineage A. However, the characterization and subsequent phylogenetic analysis of the viral strains involved in the latest two human outbreaks in the Republic of Congo (Mandza in November 2003 and Etoumbi in May 2005) proved that these strains belonged to lineage B. These findings prompted the scientific team to push the investigations further. A similar phylogenetic analysis performed on another sequence of the viral genome, coding this time for nucleoprotein (NP 1), showed that the viral strains responsible for human epidemics that occurred between 2001 and 2003 all fall into lineage B.

The IRD researchers consider that these seemingly contradictory results in fact provide proof that the wild strains of Ebolavirus are capable of exchanging genetic material by recombination processes. This process is currently well known for positive RNA viruses(1) such as HIV, but it is much more rare for negative RNA viruses to which the Filoviridae family viruses (Ebola, Marburg) belong. The involvement of this genetic recombination, never described in this family of viruses, carries new clues as to the processes of emergence of Ebolavirus in humans and the great apes. It also suggests that some still unknown, much less pathogenic, strains circulate in the wild.

Estimates derived from this research put the time of the recombination events at between 1996 and 2001. The events would in particular have given rise to viruses responsible for epidemics that struck Gabon and the Republic of Congo between 2001 and 2003. Now if genetic recombination mechanisms are indeed part of the arsenal of the Ebolavirus, this element must be taken into account for prospects of developing live attenuated vaccines for prevention strategies against the virus-induced haemorrhagic fever epidemics.

In such a context this type of vaccine, whose basic principle lies in the triggering of a strong immune reaction in a patient by inoculation with a virus with strongly attenuated pathogenicity, would carry the risk of generating undesirable effects. Attenuated virus could for example hybridize with one of the wild strains of the Ebolavirus and hence give rise to a new pathogenic virus. With the aim of characterizing better the processes involved, the next step is to identify the exact genome location on the where this genetic material exchange between viral lineages takes place. In order to do that, the complete genetic mapping of the different viral strains remains to be accomplished.

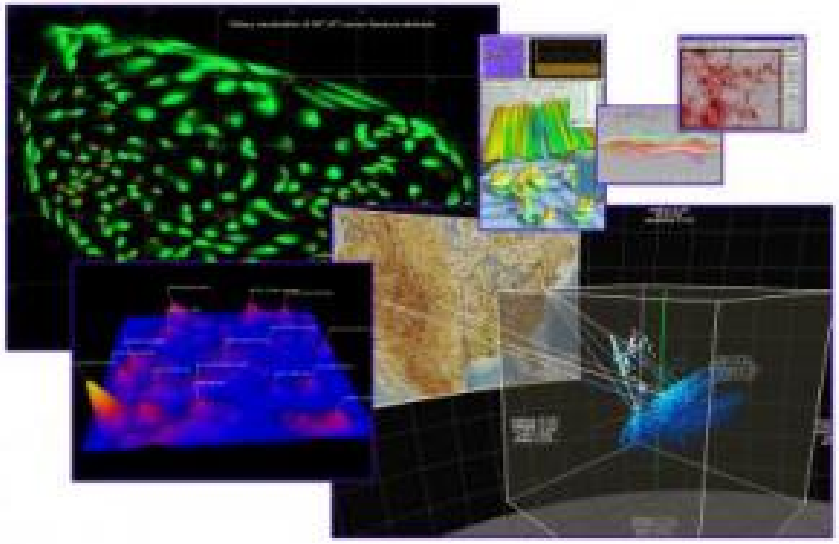
(1) The genome of RNA viruses can be coded in two different directions. The genes are either stored in the direction 5'->3' (positive polarity or +), as is the case in the messenger RNA contained in our human cells, or in the opposite direction (negative polarity or -).

Journal reference: Reference: Tatiana J. Wittmann, Roman Biek, Alexandre Hassanin, Pierre Rouquet, Patricia Reed, Philippe Yaba, Xavier Pourrut, Leslie Real, Jean-Paul Gonzalez, and Eric M. Leroy "First isolates of Zaire Ebolavirus from wild apes reveal new genetic lineage and recombinants," Proceedings of the National Academy of Sciences of the United States of America, 2007, 104, (43), 17123-17127, doi_10.1073_pnas.0704076104

Adapted from materials provided by Institut de Recherche Pour le Développement.

http://www.sciencedaily.com/releases/2007/11/071112085235.htm

Google Meets Sherlock Holmes



Scatter plots, 2-D shapes, rotatable 3-D clouds, animation -- these and other techniques are being explored to help analysts see clues in mountains of "fuzzy" data. (Credit: DHS S&T)

ScienceDaily (Nov. 19, 2007) — Soon after 9-11, Americans wondered aloud: How did our guardians miss the clues" Suspects on watch lists had moved money in curious ways. "Chatter" had risen in recent months. A visitor to the country had offered cash to learn how to fly--but not land--a jetliner. In hindsight, these telltale nuggets provided evidence of the terror to come.

Or did they" Most such nuggets were buried in a landslide of data arriving faster than analysts could make sense of it. A day's take would fill more than 6 million 160-gigabyte iPods. Moreover, like people, the nuggets sometimes disagreed. And like a story told and retold, their message changed, sometimes imperceptibly.

Finally, most nuggets are cast in unstructured, "fuzzy" data. The same face--or is it"--may appear in three surveillance videos. Someone in Florida is snapping up potential makeshift detonators on eBay. Such clues, like most, don't come conveniently packaged in a tidy spreadsheet or searchable text; they must be inferred from photos, videos, voice.

To thwart the next 9-11, analysts must meld the encyclopedic eye of Google with the inductive genius of Sherlock Holmes.

Late last century, Edward Tufte catalogued ways to display data that were either structured (train schedules) or similar (death rates). Today, researchers at the DHS Science and Technology Directorate are creating ways to see fuzzy data as a 3-dimensional picture where threat clues can jump out.

The field of visual analytics "takes Tufte's work to the next generation," says Dr. Joseph Kielman, Basic Research Lead for the Directorate's Command, Control and Interoperability Division. Kielman advises the National Visualization and Analytics Center, based at Pacific Northwest National Laboratory, and its university partners, called the regional centers.

The centers' interdisciplinary researchers are automating how analysts recognize and rate potential threats. Mathematicians, logicians, and linguists make the collective universe of data assume a meaningful shape. They assign brightness, color, texture, and size to billions of known and apparent facts, and they create rules to integrate these values so threats stand out. For example, a day's cache of video, cell phone calls, photos, bank records, chat rooms, and intercepted emails may take shape as a

blue-gray cloud (picture, lower-right). If terror is afoot in L.A. and Boston, those cities are highlighted on a U.S. map (picture, center).

A month of static views might be animated as a "temporal" movie, where a swelling ridge reveals a growing threat.

"We're not looking for 'meaning,' per se," Kielman explains, "but for patterns that will let us detect the expected and discover the unexpected." Neither the researchers nor the analysts, he says, need to understand the terrorists' language--no small advantage, given the shortage of cleared linguists.

It will be years before visual analytics can automatically puzzle out clues from fuzzy data like video, cautions Kielman: "The pre-9/11 chatter didn't say, 'We're going to plow airplanes into the Twin Towers.' To correlate these facts, you must get relational," connecting screen names with bank records, bank records with faces. How researchers will get there remains an unwritten story. But with each chapter, the plot thickens.

Adapted from materials provided by US Department of Homeland Security - Science and Technology.

http://www.sciencedaily.com/releases/2007/11/071114095244.htm

'Noah's Flood' Kick-started European Farming?

A woodcut from the Nuremberg Bible of Noah's Ark, depicting the ship built by the Hebrew patriarch to save himself, his family and a pair of each species of animal and bird from the Flood (Old Testament, Genesis 6-8), circa 1493. Victoria & Albert Museum. (Credit: iStockphoto/Photo by Hulton Archive/Getty Images)

ScienceDaily (Nov. 19, 2007) — The flood believed to be behind the Noah's Ark myth kick-started European agriculture, according to new research by the Universities of Exeter, UK and Wollongong, Australia. New research assesses the impact of the collapse of the North American (Laurentide) Ice Sheet, 8000 years ago. The results indicate a catastrophic rise in global sea level led to the flooding of the Black Sea and drove dramatic social change across Europe.

The research team argues that, in the face of rising sea levels driven by contemporary climate change, we can learn important lessons from the past.

The collapse of the Laurentide Ice Sheet released a deluge of water that increased global sea levels by up to 1.4 metres and caused the largest North Atlantic freshwater pulse of the last 100,000 years. Before this time, a ridge across the Bosporus Strait dammed the Mediterranean and kept the Black Sea as a freshwater lake. With the rise in sea level, the Bosporus Strait was breached, flooding the Black Sea.

This event is now widely believed to be behind the various folk myths that led to the biblical Noah's Ark story. Archaeological records show that around this time there was a sudden expansion of farming and pottery production across Europe, marking the end of the Mesolithic hunter-gatherer era and the start of the Neolithic. The link between rising sea levels and such massive social change has previously been unclear.

The researchers created reconstructions of the Mediterranean and Black Sea shoreline before and after the rise in sea levels. They estimated that nearly 73,000 square km of land was lost to the sea over a period of 34 years. Based on our knowledge of historical population levels, this could have led to the displacement of 145,000 people. Archaeological evidence shows that communities in southeast Europe were already practising early farming techniques and pottery production before the Flood. With the

catastrophic rise in water levels it appears they moved west, taking their culture into areas inhabited by hunter-gatherer communities.

Professor Chris Turney of the University of Exeter, lead author of the paper, said: "People living in what is now southeast Europe must have felt as though the whole world had flooded. This could well have been the origin of the Noah's Ark story. Entire coastal communities must have been displaced, forcing people to migrate in their thousands. As these agricultural communities moved west, they would have taken farming with them across Europe. It was a revolutionary time."

The rise in global sea levels 8000 years ago is in-line with current estimates for the end of the 21st century. Professor Chris Turney continued: "This research shows how rising sea levels can cause massive social change. 8,000 years on, are we any better placed to deal with rising sea levels? The latest estimates suggest that by AD 2050, millions of people will be displaced each year by rising sea levels. For those people living in coastal communities, the omen isn't good."

This research was published in the journal Quaternary Science Reviews.

Adapted from materials provided by University of Exeter.

http://www.sciencedaily.com/releases/2007/11/071118213213.htm

Scorpion Toxin Makes Insecticidal Fungus Deadly To Insect Pests

Fungus injected with deadly scorpion toxin can kill mosquitoes quickly. (Credit: Image courtesy of University of Maryland, College Park)

ScienceDaily (Nov. 19, 2007) — University of Maryland entomology professor Raymond St. Leger has discovered how to use scorpion genes to create a hypervirulent fungus that can kill specific insect pests, including mosquitoes that carry malaria and a beetle that destroys coffee crops, but does not contaminate the environment as chemical pesticides do.

In the November issue of the journal Nature Biotechnology, St. Leger and Chengshu Wang, a colleague from the Chinese Academy of Sciences, describe how they were able to bioengineer a new version of the fungus Metarhizium anisopliae to inject specific insects with the scorpion toxin Androctonus australis insect neurotoxin (AaIT), and kill them within a few days.

“Scorpions have toxins that are superbly adapted to killing insects,” explains St. Leger. “A scorpion kills by stabbing its prey, so we were looking for a way to get the toxin into the insect without the scorpion.

“Fungi are really good at that because they are naturally infective. They land on the insect’s outer surface, insert little tubes called hyphae, and grow within the insect. You could almost see them as tiny hypodermic needles. If you can get the fungus to insert a toxin into the insect, you can kill the insect very quickly. This is what we did.”

Speeding up the Process

The naturally occurring M. anisopliae fungus and other strains like it are already being used to control agricultural pests and mosquitoes, but their effectiveness has been limited in comparison to chemical pesticides. Unlike chemical pesticides, these altered fungi can be used to target specific insects and do not pose a threat to the environment.

In Australia, the fungus is sprayed from airplanes to target locusts and grasshoppers that decimate food crops. In Africa, the spores of the M. anisopliae fungus are put on sheets and hung inside houses to kill mosquitoes. “The problem is it takes quite a few fungal spores to kill the mosquito, and it is slow,” says St. Leger. “It reduces the number of mosquito bites that people get, but it doesn’t keep people

from getting malaria or dengue. We're trying to get a supercharged, hypervirulent fungus that will take out the mosquitoes quickly."

St. Leger also is looking at the possibility of using the enhanced fungus to attack the coffee berry borer, an invasive beetle that causes severe damage to organic coffee crops in Colombia and other parts of Latin America. After oil, coffee is the largest legally traded commodity in the world, so the industry is eager to develop biopesticides that will protect the crop.

Synthetic Gene

To produce the insect-killing fungus, St. Leger created a synthetic scorpion gene which he inserted into the M. anisopliae fungus. "You can't just take out the scorpion gene and put it into the fungus. You have to turn that piece of DNA into something that the M. anisopliae can use properly," he explains.

He also had to create what he calls an "on/off switch" in front of the gene so the fungus will produce the scorpion toxin only when it is in the blood of the insect. "The fungus will never produce it under any other circumstances."

St. Leger tested the infectivity of the transgenic fungus against mosquitoes, caterpillars and the coffee borer beetle. It was nine times more virulent than the wild M. anisopliae in killing mosquitoes, 22 times more virulent to caterpillars, and 30 times more virulent to the coffee borer beetle.

St. Leger believes this supercharged, pathogenic fungus has great potential to become a cost effective biopesticide that can kill using far fewer spores than the wild M. anisopliae fungus. He is currently using a range of genes, including scorpion toxins, to create additional biocontrol agents that are also highly specific to important pest species.

The journal article is entitled "A scorpion neurotoxin increases the potency of a fungal insecticide."

Adapted from materials provided by University of Maryland, College Park.

http://www.sciencedaily.com/releases/2007/11/071117211405.htm

Sitting May Increase Risk Of Disease

ScienceDaily (Nov. 20, 2007) — Most people spend most of their day sitting with relatively idle muscles. Health professionals advise that at least 30 minutes of activity at least 5 days a week will counteract health concerns, such as cardiovascular disease, diabetes and obesity that may result from inactivity. Now, researchers at the University of Missouri-Columbia say a new model regarding physical activity recommendations is emerging. New research shows that what people do in the other 15 and a half hours of their waking day is just as important, or more so, than the time they spend actively exercising.

"Many activities like talking on the phone or watching a child's ballgame can be done just as enjoyably upright, and you burn double the number of calories while you're doing it," said Marc Hamilton, an associate professor of biomedical sciences whose work was recently published in Diabetes. "We're pretty stationary when we're talking on the phone or sitting in a chair at a ballgame, but if you stand, you're probably going to pace or move around."In a series of studies that will be presented at the Second International Congress on Physical Activity and Public Health in Amsterdam, Hamilton, Theodore Zderic, a post-doctoral researcher, and their research team studied the impact of inactivity among rats, pigs and humans. In humans, they studied the effects of sitting in office chairs, using computers, reading, talking on the phone and watching TV.

They found evidence that sitting had negative effects on fat and cholesterol metabolism. The researchers also found that physical inactivity throughout the day stimulated disease-promoting processes, and that exercising, even for an hour a day, was not sufficient to reverse the effect.There is a misconception that actively exercising is the only way to make a healthy difference in an otherwise sedentary lifestyle. However, Hamilton's studies found that standing and other non-exercise activities burn many calories in most adults even if they do not exercise at all. "The enzymes in blood vessels of muscles responsible for 'fat burning' are shut off within hours of not standing," Hamilton said. "Standing and moving lightly will re-engage the enzymes, but since people are awake 16 hours a day, it stands to reason that when people sit much of that time they are losing the opportunity for optimal metabolism throughout the day."

Hamilton hopes that creative strategies in homes, communities and workplaces can help solve the problem of inactivity. Some common non-exercise physical activities that people can do instead of sitting include performing household chores, shopping, typing while standing and even fidgeting while standing. Given the work of muscles necessary to hold the body's weight upright, standing can double the metabolic rate. Hamilton believes that scientists and the public have underestimated common activities because they are intermittent and do not take as much effort as a heavy workout."To hold a body that weighs 170 pounds upright takes a fair amount of energy from muscles," Hamilton said. "You can appreciate that our legs are big and strong because they must be used all the time. There is a large amount of energy associated with standing every day that can't be easily compensated for by 30 to 60 minutes at the gym."Only 28 percent of Americans are getting the minimal amount of recommended exercise. Hamilton predicts that eventually there will be health campaigns with doctors advocating limiting sitting time, just like they ask people to limit sun and second hand smoke exposure."The purpose of medical research is to offer effective new strategies for people whom the existing therapies are not working," Hamilton said. "Because our research reveals that too little exercise and excessive sitting do not change health by the same genes and biological mechanisms, it offers hope for people who either are not seeing results from exercise or can not exercise regularly. The lifestyle change we are studying is also unlike exercise because it does not require that people squeeze an extra hour into their days and/or get sweaty at the gym, but instead improving the quality of what they already are doing. One misrepresentation is that people tend to say 'I sit all the time, so your studies suggest that I can't even work,' but Ben Franklin and Thomas Jefferson showed us that you can be very productive and still do great work in an office with a 'standing' desk."

Adapted from materials provided by University of Missouri-Columbia.

http://www.sciencedaily.com/releases/2007/11/071119130734.htm

King Abdullah University of Science and Technology

KAUST DISCOVERY SCHOLARSHIPS

The KAUST Discovery Scholarship is the general scholarship program of the King Abdullah University of Science and Technology (KAUST).

This program is designed to ensure that any highly talented student who is qualified and eligible to enroll in KAUST will receive full financial support while at the University. Those who receive a Discovery Scholarship will receive full tuition support, a living stipend, and summer and career enrichment programs.

Recipients of the KAUST Discovery Scholarship represent future leaders in science, engineering and technology.

KAUST will offer Discovery Scholarships to all KAUST students – an exceptional level of support intended to attract gifted and talented students from Saudi Arabia and from other countries around the world.

KAUST will offer a pre-enrollment version of this general scholarship program to students attending first-university or bachelor's degree programs. KAUST will provide financial support to pre-enrollment Discovery Scholarship recipients at their home institutions prior to the University's opening. Upon graduation, these students will enter KAUST as master's degree students in September 2009 and 2010 to complete their graduate studies on a fully funded scholarship.

Recipients of the KAUST Discovery Scholarship represent future leaders in science, engineering and technology.

Students may apply for a KAUST Discovery Scholarship directly, or they may be nominated by a professor at their institution.

All applicants must fully complete and submit their online application by November 9, 2007.

http://www.kaust.edu.sa/students/discovery-scholarships.aspx

Migraine shows up in the brain

Tuesday, 20 November 2007 Will Dunham
Reuters

Scientists who've noticed structural differences in the brains of people with migraines can't say which came first, the migraines or the brain differences. (Source: iStockphoto)

People who get migraines have structural differences in their brains notably in the cortex area that processes pain and other sensory information from the body, scientists say.

The researchers, whose findings are published in the journal *Neurology*, say it is unclear whether these brain differences actually cause migraines or are themselves caused by these severe, recurrent headaches.

The researchers performed brain scans on 24 people who had a long history of frequent migraines, about four a month for 20 years, and 12 people who did not get migraines.

The somatosensory cortex - the area of the brain that detects sensations like pain, touch and temperature in various parts of the body - was 21% thicker in the people who got migraines compared to those who did not.

The biggest difference was in the part of the cortex responsible for processing sensory information from the head and face, says Dr Nouchine Hadjikhani of Massachusetts General Hospital, who led the study.

Hadjikhani says the study illustrates the seriousness of migraines.

"It has to be taken seriously because it can induce changes in your brain," she says.

Migraines are a type of painful headache commonly accompanied by nausea, vomiting and heightened sensitivity to light and sound.

Women are three times more likely than men to experience these headaches. Many people who get them have a family history of migraines.

"The more we understand about the pathophysiology of migraine, the better we will be able to design drugs that work. At the moment, there is no drug for prevention that works well," Hadjikhani says.

Brain disorder

Dr David Dodick, a professor of neurology at the Mayo Clinic who is not involved in the study, says the study shows that migraines are a brain disorder.

"And it shows that migraine has some durable, long-lasting morphological or structural changes in the brain over time," he says.

Dodick says he would be interested to know whether people who get migraines less frequently have the same brain changes.

Hadjikhani says one possibility is that repeated, long-term overstimulation of sensory fields in the cortex may cause it to become thicker over time.

Another possibility is that people predisposed to migraines already have this thicker cortex, Hadjikhani says.

According to the US National Institutes of Health, researchers suspect migraines are caused by inherited abnormalities in genes that control certain cells in the brain.

For many years, scientists had thought migraines were linked to the dilation and constriction of blood vessels in the head.

Dr Seymour Diamond, executive chair of the US National Headache Foundation, says he findings further confirm that migraines are a neurological disease.

Researchers have also seen differences in cortex thickness in other diseases.

It is thinner, for example, in people with multiple sclerosis, Alzheimer's disease and autism.

http://www.abc.net.au/science/articles/2007/11/20/2095720.htm?site=science&topic=latest

Blow-up building faces Antarctic test

Tuesday, 20 November 2007 Irene Klotz
Discovery News

How do you test a blow-up building meant for astronauts on the moon without actually going there? Scientists think testing it in Antarctica is the next best thing. (Source: Peter West/NSF)

A prototype inflatable building that the US space agency is thinking of using on the moon is being packed up and shipped to Antarctica for a 13-month test run.

It's not the moon, but McMurdo Station near the south pole is about as close as it gets without leaving the planet.

Since every kilogram landed on the moon will require 125 kilograms of hardware and fuel to get there, NASA needs lightweight but durable structures to house its astronauts.

They are scheduled to return to the lunar surface in 2020 for the first time since the Apollo program ended in 1972.

"Testing the inflatable habitat in one of the harshest, most remote sites on Earth gives us the opportunity to see what it would be like to use for lunar exploration," says Paul Lockhart, who oversees the new exploration program, known as Constellation.

The habitat, built by Delaware-based ILC Dover, is scheduled to begin its trek to Antarctica this week.

By January, it is to become the newest structure of the sprawling McMurdo Station, located on Ross Island's Hut Point Peninsula.

McMurdo, which has been operating for more than 50 years, supports a population of more than 1000 people during the summer and includes a harbour, airport and helicopter pad as well as water, sewer, telephone and electrical systems.

The station is managed by the US National Science Foundation (NSF).

During the winter, the number of scientists and support personnel at McMurdo shrinks to about 250.

NASA, which is sponsoring the project in partnership with NSF and ILC Dover, plans to leave the inflatable habitat in place until February 2009.

Researchers are eager to learn how the building fares after 13 months in the frigid climate. In addition to first-hand reports from McMurdo residents, the habitat contains sensors that can record key data.

More homes in space

The US space agency previously funded research and development of a prototype inflatable module for the International Space Station, but both it and a more traditional crew housing module were cancelled to save money.

Las Vegas-based Bigelow Aerospace later worked with NASA to use its research on inflatable structures and develop models for commercial orbital habitats. The company presently has two mock-ups in orbit.

In the wake of the 2003 Columbia accident and the decision to retire the space shuttle fleet in 2010, the US is redirecting its human spaceflight program from low-Earth orbit research to exploration of the moon, Mars and other bodies in the solar system.

NASA plans to keep astronaut crews on the moon for longer missions, eventually setting up a permanently occupied base there.

Powered, heated huts

The prototype habitat, which is pressurised, has 35 square metres of living space and includes power and heating.

"It only takes four crew members a few hours to set up, permitting exploration beyond the initial landing area," Lockhart says.

For its part, NSF is looking for easily assembled habitats to replace the 50-year-old hut designs at McMurdo.

The agency will track how the inflatable structure is packed, transported and set up, as well as monitor its power consumption and durability.

http://www.abc.net.au/science/articles/2007/11/20/2095522.htm?site=science&topic=latest

Jade earrings open door on ancient trade

Tuesday, 20 November 2007 Dani Cooper
ABC

This 2000-year-old jade earring is made of Taiwan nephrite, unearthed in Vietnam and the Philippines .
(Source: PNAS/Yoshiyuki Iizuka)

Taiwan was at the centre of a one of the most extensive sea-based trade networks in the prehistoric world, new research shows.

The network, which traded in Taiwanese jade, has been uncovered after mineral analysis determined the source of jade used in two types of earring.

Lead researcher Hsiao-chun Hung, of the Australian National University in Canberra, says since the 1930s archaeologists have noticed two very specific styles of ancient jade earring common across Southeast Asia.

These are the three-pointed, so-called lingling-o earring, and the double-headed animal ear pendant.

Hung says mineral analysis of a number of these has shown most are made from Taiwanese jade.

Her finding overturns the long-held theory that the earrings originated in northern Vietnam and spread to the Philippines and Taiwan.

It also suggests, she says in the latest *Proceedings of the National Academy of Sciences* journal, the existence of a small group of highly skilled jade craftsmen who carried or acquired the jade from Taiwan.

They then travelled the region, with or without the help of transporting middlemen, making "extremely uniform jade ear ornaments to suit the demands of the local elites".

As part of the study, Hung and her colleagues created a mineralogical database for nephrite deposits in regions across East Asia and the Pacific.

Nephrite is one of two minerals, the other is jadeitite, that are commonly known as jade.

And it is the nephrite that's found in artefacts studied from Taiwan, the Philippines and Vietnam.

The team developed a way of identifying Taiwanese jade based on the mineral chemistry of the nephrite and the zinc chromite inclusion minerals.

Of 144 jade artefacts from 49 sites the researchers analysed using non-invasive scanning equipment, 116 specimens from 38 sites were made from Taiwan jade.

Contact

"This is very strong evidence that ancient populations in different regions had very frequent contact and communication," says Hung, of the university's Department of Archaeology and Natural History.

She says this shows contact between Taiwan and the Philippines stretches back 4000 years.

Hung says the findings also help in understanding how skilled and technologically advanced the populations were at that time.

The ear ornaments, which were highly valued by the elite, required high levels of skill, but also considerable labour input, she says.

Hung says experimental archaeological research has shown eight hours of sawing jade using a stone knife and sand creates a groove only 11 millimetres deep.

And one hour of drilling using a hollow bamboo with sand and water cuts only 10 millimetres below the surface.

"We are very sure they had no iron tools," Hung says.

"But at the moment we cannot reconstruct the whole process of [jade earring] production."

Hung says she will now try to understanding the production techniques and how items such as bamboo drills and slate cutting tools are used.

http://www.abc.net.au/science/articles/2007/11/20/2095026.htm?site=science&topic=latest

Sudoku may save us from spam

Monday, 19 November 2007 Stephen Pincock
ABC

We can reduce the amount of spam in our inboxes by making email servers play Sudoku,

Tricky mathematical puzzles like Sudoku could be the next weapon in the fight against spam, an Australian computer scientist suggests.

Paul Gardner-Stephen from Flinders University in Adelaide is looking for ways to improve existing spam filters, which try to prevent unwanted email from getting to your inbox.

"The trouble is that they're not entirely accurate, so you still get some spam in your inbox and some real mail gets bounced," he says.

His idea is to supplement existing filters with an automatic system that requires mail servers to solve a mathematical puzzle if they want their message to reach you.

Gardner-Stephen is due to describe the system at a meeting of the Institute of Electrical and Electronics Engineers in Adelaide this week.

He also publishes his paper on the arXiv website.

First, the mail server computer that receives your email would use an existing spam filter to decide how likely it is that an incoming message is spam.

If it looks suspect, the server would automatically respond to the sending server with a mathematical challenge to solve before the message is delivered.

The more certain your spam filter is that the message is junk, the harder the puzzle would be to solve.

For messages that are clearly spam, the puzzle could be set to take about an hour to solve, Gardner-Stephen says.

"If someone's trying to send spam, they end up with a lot of puzzles to solve, so they can only send relatively few messages a day," he says.

Mail server has to do some work

In technical terms, the system is known as a 'proof-of-work' scheme. By providing a solution to the puzzle, the sending mail server is proving that the message is important enough for it to do a certain amount of work.

"Sudoku is a good example of the kind of puzzle," Gardner-Stephen says. "It's easy to verify you've got it right, but not easy to do."

So far, the system only exists in theoretical form, but Gardner-Stephen is planning to try a test on a single mail server within the next year.

If all goes well, it might take 5-10 years for a system like this to be adopted across the many thousands of mail servers across the internet, he says.

http://www.abc.net.au/science/articles/2007/11/19/2094677.htm?site=science&topic=latest

Handwriting a window to your heart?

Monday, 19 November 2007 Anna Salleh
ABC

The early signs of heart disease may show up in your handwriting, says one researcher, an idea others have likened to palm reading.

Findings of study carried out at the UK's Poole Hospital were presented at a recent International Graphonomics Society conference in Melbourne.

Handwriting researcher Christina Strang reported she had analysed the handwriting of over 100 people in their early 60s, including 61 patients at the hospital's cardiac clinic.

She also analysed the writing of 41 people who had not been diagnosed with cardiac disease.

Strang says previous studies have focused on the effect on writing of neurological conditions such as Parkinson's, Huntington's and Alzheimer's diseases.

But she wanted to see if cardiac disease could also leave its mark.

Strang analysed magnified samples of writing for various features including breaks in the writing, malformed 'o's and resting dots, where the pen rests momentarily in the middle of a pen stroke.

She found that people in the cardiac clinic group had a statistically significant higher number of resting dots than the control group, especially in the upper middle zone of the letters 'a', 'e' and 'o'.

Strang says she has submitted the findings for publication and attempts to replicate the findings are now under way.

She says much research in this area has been very unscientific and she is attempting to bring some rigour to it.

Credibility gap

But some researchers think the paper has little hope of being published in a clinical journal.

"I am afraid it does not pass the credibility test," says neuropsychiatrist Professor Perminder Sachdev of the University of New South Wales, who viewed Strang's paper.

He says there are problems with the way study participants were selected and studied.

Sachdev also wonders what possible mechanisms there could be to link handwriting with heart disease and criticises Strang for failing to offer any interpretation of her findings."Is it that the patients are more tired and therefore pause a lot while writing?" he says.

Dr Karen Stollznow of the Australian Skeptics says Strang appears to be a proponent of the "pseudoscience" of "graphology".

"Graphology is the handwriting equivalent of palm reading," says Stollznow, who is based in the US.

Graphonomy or graphology?

She says while there are scientific approaches to handwriting analysis, which should be referred to as graphonomy, the two terms are often confused and the terms used interchangeably.

"Handwriting production might be affected by some disorders (eg Parkinson's disease) but this is not to say that handwriting style can be an indicator of disease, and specifically heart disease," says Stollznow."Simply, there isn't any evidence to correlate heart disease with handwriting style, or to suggest that handwriting style can be used to accurately diagnose illness."

Strang now plans to collaborate with Dr Andrew McLeod, the senior cardiac consultant at Poole Hospital, to test a much larger group of diagnosed heart disease patients.

She says while McLeod was initially sceptical that non-neurological conditions could leave their mark in handwriting, he was impressed by the preliminary findings.

Strang hopes one day handwriting analysis can predict the early stage of heart disease without the need for invasive and expensive techniques.

Writing while drunk

Australian researchers meanwhile have been studying the impact of alcohol intoxication on handwriting.Dr Jim Phillips of Monash University and colleagues studied the impact of three to five standard drinks of vodka and orange on the handwriting of 20 men in their 20s.

"Their handwriting got larger," says Phillips.

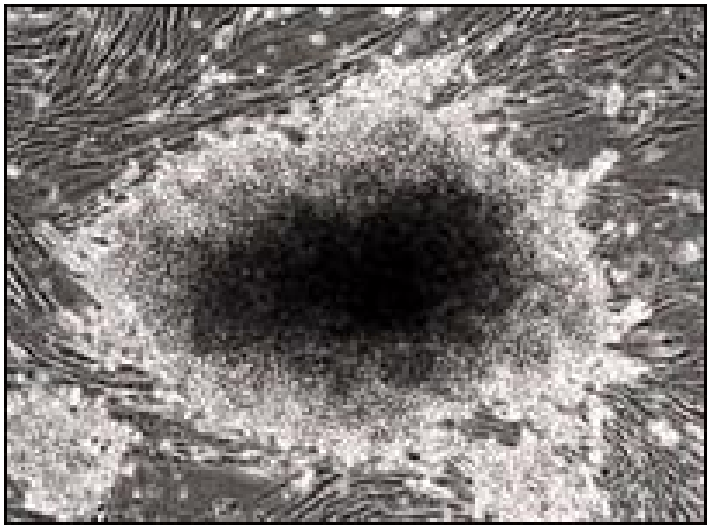
His team found that having a blood alcohol reading of about 0.05% changed the speed at which pen strokes began and ended."The acceleration phase seemed to be longer and the deceleration phase seemed to be shorter," says Phillips.

While the finding that a few drinks causes problems with your fine-motor skills may not be surprising, Phillips there is very little research on the impact of alcohol on handwriting.

He says the findings may assist in forensic investigations, trying to determine whether someone was under the influence

http://www.abc.net.au/science/articles/2007/11/19/2093164.htm?site=science&topic=latest

Skin transformed into stem cells
Human skin cells have been reprogrammed by two groups of scientists to mimic embryonic stem cells with the potential to become any tissue in the body.



The breakthrough promises a plentiful new source of cells for use in research into new treatments for many diseases.

Crucially, it could mean that such research is no longer dependent on using cells from human embryos, which has proved highly controversial.

The US and Japanese studies feature in the journals Science and Cell.

> **The induced cells do all the things embryonic stem cells do - its going to completely change the field**
> Professor James Thomson
> University of Wisconsin-Madison

Until now only cells taken from embryos were thought to have an unlimited capacity to become any of the 220 types of cell in the human body - a so-called pluripotent state.

But campaigners have objected to their use on the grounds that it is unethical to destroy embryos in the name of science.

In the US only limited use of embryonic stem cells is allowed by scientists receiving public funding.

The Japanese team used a chemical cocktail containing just four gene-controlling proteins to transform adult human fibroblasts - skin cells that are easy to obtain and grow in culture - into a pluripotent state.

> **For once we have better science coinciding with better ethics**
> Josephine Quintavalle
> Comment on Reproductive Ethics

The cells created were similar, but not identical, to embryonic stem cells, and the researchers used them to produce brain and heart tissue.

After 12 days in the laboratory clumps of cells grown to mimic heart muscle tissue started beating.

The US team, from the University of Wisconsin-Madison, achieved the same effect by using a slightly different combination of chemicals.

They have created eight new stem cell lines for potential use in research.

Cloning superceded

Using skin cells should mean that treatments could be personalised for individual patients, minimising the risk of rejection.

> **Although it is early days for this technique it may well prove to be every bit as significant as the first derivation of human embryonic stem cells nine years ago**
> Dr Lyle Armstrong
> University of Newcastle Upon Tyne

Not only does the new technique remove the need to create embryos in the lab, it is also more simple, and more precisely controlled than current cloning technology.

Professor Ian Wilmut, of the University of Edinburgh, who led the team which created Dolly the sheep in 1996, has said it represents a significant advance.

However, the researchers have warned more work is needed to refine the process, and ensure its safety.

At present both techniques rely on viruses to introduce new material into the cells, which carries a potential risk.

Researcher Professor James Thomson said: "The induced cells do all the things embryonic stem cells do.

"It's going to completely change the field."

Dr Shinya Yamanaka, of Kyoto University, a member of the Japanese research team, said: "These cells should be extremely useful in understanding disease mechanisms and screening effective and safe drugs."

Positive reaction

Professor Azim Surani, of the University of Cambridge, said the research should allow scientists to create a large range of human stem cell types, which could prove invaluable in studying disease.

He said: "It is relatively easy to grow an entire plant from a small cutting, something that seems inconceivable in humans.

"Yet this study brings us tantalisingly close to using skin cells to grow many different types of human tissues.

Dr Lyle Armstrong, of the International Centre For Life at the University of Newcastle Upon Tyne, called the studies a "major development".

He said: "Although it is early days for this technique it may well prove to be every bit as significant as the first derivation of human embryonic stem cells nine years ago."

Professor Robin Lovell-Badge, of the Medical Research Council's National Institute For Medical Research, said the work was exciting, but work was required to end the reliance on viruses, and to tease out why two different techniques produced similar results.

Josephine Quintavalle, of Comment on Reproductive Ethics, said: "News that embryonic stem cells can be created successfully from human cells without cloning, without using human embryos or human eggs, or without getting involved in the creation of animal-human embryos, is most warmly welcomed.

"We congratulate these world-class scientists who have had the courage to state their change of tack so cogently.

"For once we have better science coinciding with better ethics."

TECHNIQUES FOR MAKING 'STEM CELLS'
Therapeutic cloning produces stem cells which can develop into different types of body cell, making them ideal for research into treatment of disease.
But this technology involves the creation and destruction of embryos, which is ethically controversial. The stem cells created also run the risk of being rejected by the body.
The new technology, nuclear reprogramming, creates stem-like cells from the patient's own cells, avoiding both these problems.

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/7101834.stm

Published: 2007/11/20 17:01:19 GMT

Gene therapy treats Parkinson's
An experimental form of gene therapy for Parkinson's disease has been shown to produce promising results.

US scientists treated 12 patients with a virus genetically modified to carry a human gene which dampens down the nerve cells over-excited by Parkinson's.

Now brain scans have revealed significant improvements - which were still present a year later.

The study, led by the University of New York, features in Proceedings of the National Academy of Sciences.

> **This study important as it suggests that it was the therapy itself, rather than a placebo effect, that was having a positive impact on patients' symptoms**
> Dr Kieran Breen
> Parkinson's Disease Society

However, the work is still at an early stage. The main aim was to test whether the therapy was safe.

Scientists delivered the gene only to one side of the brain - that which controls movement on the side of the body most affected by Parkinson's - to reduce the potential risk.

It makes an inhibitory chemical called GABA that turns down the activity in a key part of the pathway which controls movement.

Motor network changes

The US team tested the impact of the therapy by using a form of brain imaging known as positron emission tomography (PET) to track changes in the brain.

They focused on two discrete brain networks - one that regulates movement, and another that affects thinking processes.

Only the motor networks were altered by the therapy - but this was all the researchers had hoped for.

The scans showed that the motor network on the untreated side of the body got worse, and that on the treated side got better.

The improvement was reflected in an improvement in patients' symptoms.

They began to show signs of improvement one month after starting therapy, and by six months movement had improved by an average of 30%.

One patient registered an improvement of 65%.

The brain scans also showed those patients who received the highest dose of the gene therapy registered the longest-lasting effect.

Lead researcher Dr David Eidelberg said: "Having this information from a PET scan allows us to know that what we are seeing is real.

"This study demonstrates that PET scanning can be a valuable marker in testing novel therapies for Parkinson's disease."

Parkinson's, which affects around 120,000 people in the UK, is caused by the loss of brain cells, which leads to a drop in chemicals required to regulate cell activity, and the connections they make with their neighbours.

Dr Kieran Breen, of the Parkinson's Disease Society, said the disease was likely to be caused by a mix of genetic and environmental factors.

"Because of this, there are many potential ways to treat or cure Parkinson's, and gene therapy is one potential route holding a lot of promise," he said.

"This study is important as it suggests that it was the therapy itself, rather than a placebo effect, that was having a positive impact on patients' symptoms."

Story from BBC NEWS:
http://news.bbc.co.uk/go/pr/fr/-/2/hi/health/7103127.stm

Published: 2007/11/20 10:17:59 GMT

Powering up for a hydrogen economy

VIEWPOINT

Keith Guy

Sooner or later the world is going to have to make the switch away from fossil fuels, says Keith Guy. In this week's Green Room, he explains what needs to be done to make the vision of a global hydrogen economy a reality.

An increasing global population, rising standards of living and more industrial production mean the amount of energy the world consumes could rise by 50-60% over the next 25 years.

Today, the biggest forms of energy are fossil fuels - oil, gas, coal. But that is set to change in the future for at least two reasons:

- "easy" oil and gas sources are declining
- emissions of greenhouse gases related to fossil fuels are rising to unacceptable levels

But what are the alternatives and can they ever become a reality?

Hydrogen is already providing a growing alternative energy source for transportation in several countries, including the US and Japan.

In a bold move, Iceland has set itself the challenge of becoming the world's first hydrogen economy, with the aim of the fuel supporting all its energy needs by 2050.

This means the total elimination of fossil fuels and should result in cutting the country's greenhouse emissions by up to 50%.

However, one could argue that Iceland's natural energy resources, its waterfalls and hot springs, give it an unnatural advantage over less well-endowed countries.

Making the switch

So what progress can other countries hope to achieve and what do they need to make the hydrogen economy a reality?

Let's start with a look at what advances the world is currently making.

The most obvious step that we are beginning to see is the introduction and take-up of fuel-cell powered vehicles.

Hydrogen is a very light gas making it far more difficult to work with than gasoline

Although there may be an intermediate stage with onboard gasoline reformers, these cars offer immediate benefits - they are about twice as efficient as current fossil fuel transport and can significantly reduce air pollution in cities.

Since the first hydrogen filling station was set up in 2000 in Dearborn, US, we have seen a steadily growing number opening up to meet the increased demand, especially in the US, Japan, Germany and Iceland.

Many buses in Iceland are already converted to use hydrogen and are refuelled by a filling station on the outskirts of its capital, Reykjavik. There are also plans to convert the country's entire fishing fleet.

Breaking down barriers

Unfortunately, whilst moves towards an increased use of hydrogen are starting to gather speed, as things stand this growth is restricted by a number of constraints at the political, commercial, technical and social levels.

Safety concerns are still widespread, with the spectre of the Hindenburg accident still in the minds of many.

The public perception of the dangers around hydrogen's transportation and distribution need to be addressed if we're to see widespread use in the future.

At a practical level, there are real issues in terms of how we store and transport hydrogen. Hydrogen is a very light gas making it far more difficult to work with than gasoline.

From an economic point of view, the costs of switching over to hydrogen-based technologies are high. In the US for example, the investment required to convert existing gasoline stations to provide hydrogen to vehicle drivers will run into billions of dollars.

While fuel cells may be getting cheaper, they are still more expensive than conventional engines.

The cost of producing the actual hydrogen itself is high, although the good news is that economies of scale do exist.

As the supply increases, the costs will start to come down. It is expected that the same will apply to the associated costs of storage, transport and vehicle design.

What we'll also need to see is a move from natural gas-based hydrogen, which is being used during the market development phase, to industrial-level hydrogen production using renewable resources on an economic basis.

This will require further development, both in the public and private sector, if we're to see any significant progress.

There is a real political need for a common worldwide approach if we are to see the transition to a hydrogen economy.

National and international government organisations must get behind the technology and provide the support for research, and ultimately the commercialisation of hydrogen, if we are to succeed in developing a viable and green alternative to fossil fuels.

The hydrogen economy is developing but more must be done if we're to see real progress in the medium to long term; only then will it cease to be a theory and become a reality.

Professor Keith Guy is a Chem Envoy for the Institution of Chemical Engineers (IChemE)

The Green Room is a series of opinion pieces on environmental topics running weekly on the BBC News website

Do you agree with Keith Guy?

Is hydrogen a viable alternative to fossil fuels? What needs to be done for a global hydrogen economy to become a reality? Or are the costs too high to make it a viable option?

Yes, Hydrogen works and could easily be used on its own or via fuel cells but there are vast practical problems in storage and supply and the laws of physics may prevent a solution to them. It is not viable to store and transport it as a gas because it uses too much volume and to store it as liquid requires keeping it cool, which uses enormous energy, or it is kept cool by evaporation, that is by some of the liquid hydrogen constantly boiling way and in a couple of weeks a stored tank full of liquid hydrogen would have boiled away 70% of its volume. Notwithstanding that, if we can solve these problems for storing hydrogen then we will be able to utilise the excess night capacity of power stations on standby which goes to waste because we cannot store electricity.
Keith Budden, Rayleigh, Essex

How do you create the hydrogen? What is the energy source for turning water into hydrogen? If it is gas, oil or coal, then CO2 emission will not fall. Why not convert cars to electricity instead? It has the same environmental benefits of hydrogen. Hydrogen fuel cells just stores engrgy like a battery, it does not create it. It is not the solution to transports energy needs.
rhodri, London

Where is Keith planning to get the Hydrogen from? If we ever get nuclear fusion to work then you could use that to split water - but with the almost unlimited energy that fusion could provide we could presumably "make" petrol, diesel and methane by splitting water and CO2 - which could then be transported and used with no changes to the existing infrastructure...
David Legge, Falkirk

The big problem with all renewable energy sources like wind generators and photo-electric cells is that they do not provide a continuous supply and we have no effective way to store electrical energy on a large scale. From a practical standpoint existing wind generators are virtually useless. Load balancing with wind generators is a nightmare since you have no idea from minute to minute what they can provide. They are only built to win browny points. Electrolysis of sea water to produce hydrogen is a good way of overcoming the energy storage problem. Generators could be located largely at sea overcoming many aesthetic objections. We already have the technology to pipe gas from sea storage to land. While setting up a distribution network to allow the hydrogen to be used in homes or cars would take time, adapting gas fired power stations and other gas fired industrial processes to run on hydrogen should be relatively easy. Large scale industrial use of hydrogen instead of natural gas should be the quickest and cheapest change. Once that infrastructure is in place it can be gradually extended to domestic uses.
Warwick Gibbons, Crete, Greece

I agree with Keith that the future of mobile energy storage has to be Hydrogen. Bio fuels may have there limited uses but they cannot replace more than a fraction of our transport needs if we want to eat as well as get from A to B. However Hydrogen is an energy store, not an energy source, and if NOT produced from fossil fuels needs significantly more energy to produce than it will store. We will need to get this energy from somewhere and a rough back-of-the-envelope calculation, assuming we generate the Hydrogen we'll need in the UK from electricity, show we'll need around twice the current generating capacity of the UK to produce it. Its thought to be just about possible to replace around 40% of our current electrical generating capacity with renewables, maybe even 60% at a push. But this is still only going to be 15-20% of what we will need, the rest will have to come from Nuclear and Clean-Coal. I do wish the different sides of the CO2 neutral sources would stop flaying at each other. None can be the final solution, we'll need them all and it is not an eithor or. Building more nuclear reactors does not mean we build less wind and wave farm, and neither should the reverse be true., We need all the CO2 neutral sources we can get our hands on.
Stephen Cooper, Letchworth G. C. Hertfordshire

Hydrogen will never be a complete solution as its EROI (Energy Return On Investment) is so low compared to oil fuels. Currently vitually all hydrogen is produced as a by-product of refining oils. Battery run vehicles will be a better solution.
Robin Lavender, Wells, England.

Hydrogen is merely a "battery" for carrying energy. Producing it requires energy, most of which will come from fossil fuels anyway--notably electricity from coal-burning power stations. This means that, currently, hydrogen-powered vehicles creates MORE pollution than conventional gas-powered vehicles. So until the industry can also produce the hydrogen in a clean manner, there's really no point to making hydrogen cars.
Chris C, Salt Lake City, UT, USA

Hydrogen as a fuel should not even be considered if it is produced from a reforming process in a refinery. This is a highly inefficient form of energy production which would render the fuel a very long way from being non-CO2 producing. Any writer who would even consider this as an environmental option should not be taken seriously as they clearly know nothing... And in this case I feel ashamed as the writer is a Chemical Engineer - like me... If it's going to be done it has to be by electrolysis which is VERY energy intensive. I don't think we have the energy available to cope.
Steve, UK

Totally agree. One of the most abundant "green" resources available on this planet and we are only just starting to see its potential. Given that we knew existing fuels were always going to run out or become too expensive to extract why has it taken so long to develop the potential of hydrogen. When you also consider we have know the harm done to the environment by fossil fuels for at least a decade you would have thought hydrogen technology would be in common use by now. As regards the cost of change, whatever new energy economy we switch over to it was always going to cost billions if not trillions. So, yes, lets make it a reality.
Dave H., Bristol UK

Please, please, please. Can somebody do the proper energy equation. Hydrogen is very clean and efficient BUT it takes more energy to produce it than you get out of it. If we take that energy into condsideration then it is a very poor choice. Energy has to come from somewhere you can't just conjur it up out of thin air.
Robin Sinton, Newcastle upon Tyne UK

By stockpiling hydrogen emulating the production of hydrocarbons by natural means then over time "clean" hydrogen would be viable. Instead of conversion of conventional fuels which is expensive you can convert gravity directly to the gas and store it for future use. I've proven it but you can't tell 'em.
Pennyworth, Derby, UK

In terms of renewable energy, hydrogen is a storage mechanism for energy, just like a battery. If it is to be used as a renewable it needs to be "created" from water. To do this electricity is needed. This is why it is a storage medium. Without renewable energy generation the hydrogen, the hydrogen cannot be considered clean. That said, if hydrogens storage problems can be sorted and mass produced, then it may become the best and cleanest portable energy medium.
Mark Williams, Billingshurst ,UK

Hydrogen is not a 'primary' fuel. It requires energy to extract hydrogen from water or other sources. Hydrogen may be useful as a means of storing and transporting energy, but in itself it does nothing to move us away from fossil fuels. We need alternative sources of energy (solar, wind, nuclear) on a massive scale. When we have them there may be a place for hydrogen.
Mike Ayres, Bodmin

Yes we NEED to switch from GAS to HYDROGEN Powered Cars,TRains trucks, ect...we need to expand our wind,water=wave powered citys...we should be all over this in a HUGE WAY!!!INVEST & EXPANDING EVEN MORE!!!i mean pure water as pollution???sounds like a win-win situation to me!!!
james jc gough, sudbury ont Canada

Keith, Your comment on the Hindenburg are misleading to those who are not aware that it was the coating on the ship that lead to the disaster and the deaths on the ground were from that flamming debree. Point taken on the Hydrogen in the ship but this is akin to saying "People are concerned about a hydrogen

Bomb". Differn form of hydrogen as you know. Keep the fuel cell/hyrdrogen articals in the front of the world.
Chris, valdez, Alaska

First. As hydrogen being energy STORAGE compared to fossil fuels being energy SOURCE it can not be their alternative. Hydrogen is clean as clean is the energy stored in it. As long as there is not an enormous spare capacity of renewable energy hydrogen will be made from coal, natural gas and nuclear power. Second. Fuel cell car is not hydrogen car - it is electric car with battery and using the fuel cell to full the battery when it is drained. Plug-in electric car with small and efficient diesel generator running on biodiesel is much more viable and cheap alternative than plug-in electric car with fuel cell. It is not very correct to lie to the people that hydrogen economy is a solution to our current energy problems. It will come (if it come) WHEN we deal with the problems not before that.
Dimitar Mirchev, Sofia, Bulgaria

Hydrogen is not a green fuel, it is just a 'carrier of energy'. The hydrogen still has to be made, either with fossil or renewable fuels. Iceland is a special case as they have massive amounts of geo-thermal energy to tap into. Most places in the world don't. Instead of building a hydrogen economy why not by-pass it altogether and use renewable energy directly? People already have electricity sockets, so suppling cleanly made electricity to power electric cars seems a much better and cheaper option.
R. Smith, Japan

You do not go into the amount of energy needed to make the hydrogen. What is the amount of energy needed to replace one gallon of gasoline with an equivalent amount of hydrogen? I think you'll find it takes electrical energy equivalent to two gallons of gasoline or perhaps more. Where will you get all that electrical power? Moreover, inexpensive, durable fuel cell technology is still confined to the lab, if it exists at all, and with existing hydrogen storage technology, a hydrogen car has a cruising range no better than the Tesla electric car. Finally, there is the fact that hydrogen leaks; it is the smallest of all molecules. Its only saving grace is that it goes up after leaking out of whatever it has escaped from, so if it diffuses through the roof, it won't accumulate in explosive quantities. Unfortunately, it is very definitely a greenhouse gas, so the more of that gets into the atmosphere, the worse our problems will be. I'm inclined to think that most of the enthusia! sm about hydrogen was cooked up by oil and auto companies, because they know that our present level of technology, it is an invitation to boondoggle. Frankly, I'm more hopeful about the hydrogen in lithium batteries. I think battery-powered electrical vehicles have a fighting chance of becoming practical.
John Silver, Port Angeles, Washington

No, not unless the hydrogen can be generated in sufficient quantity without using fossil fuels. It can't be mined, so like electricity it's only an energy transport medium. The most feasible, if unpalatable, option available at present is nuclear-generated electricity, which then begs the question - why not just use the electricity directly?
Michael Poole, Sanda, Japan

Things will change and the use of fossil fuels will be a thing of the past. Or we can continue down the same road and watch our futures dissapear! It's up to the Politicians and the News Media to start making changes otherwise it will be to little to late! As for myself i will continue driving my S550 mercedes and my F450 truck and polute with the best of them until the Politicians & the News Media decide to change things. Our future is up to them.
michael , las vegas nv.

Not just viable, the next best alternative. I see only two options with the capacity to replace oil and natural gas, hydrogen and nuclear fusion. Solar cells, used to create electricity used to separate hydrogen and oxygen seems the best alternative.
Roger Bates, Beaverton, OR, USA

A hydrogen economy would prevent CO2 emissions from cars and buses themselves but in the long run the hydrogen has to be produced from the electrolysis of water. This itself uses vast amounts of electricity which with the current methods of generation (In countries without large renewable resources such as the

UK) is still very carbon intensive. Generating electricity renewably is a far greater technological and economic barrier than a hydrogen infrastructure. Until we develop new, cleaner methods of energy generation a hydrogen economy serves only to move the problem from our streets to the polluting power stations.
Jamie, Oxford

The technology necessary to make the switch has been around for 3 decades and more. The public perception of hydrogen is not an issue. People want their cars to start and their lights to switch on. They don't CARE where the power comes from so long as it won't , kill innocent kids in war, bankrupt the family or destroy the planet. The reason the world hasn't switched over yet is very mundane. The common man does not have the choice to make it happen. Those in economic and political power do.
Mark Pinheiro, Edison, New Jersey U.S.

Hydrogen really is the answer along with advances in the generation and storage of electricity. Even if fusion technology doesn't work out, hydrogen production is an easily transferable way to store excess generation capacity from renewable energy for later use. I like the fact that it is less dangerous than current petroleum or alcohol fuels because it doesn't contain the carbon which reflects heat back when it burns. I'm also not against its use in airships as it has greater lift potential and is cheaper to produce than helium. Airships would have less of a carbon footprint than aircraft in use today and could be used to haul both cargo and people alike. A little bravery is going to be needed if global warming is to be defeated.
Dale Lanan, Longmont, Colorado USA

I suppose its come to the time to ask whether we as the human race want a good life or a long life. How much is the next generation worth? Or do we as a species all end up like the fat guy in the meaning of life (monty python)? Its choice time people.....
Udo, Melbourne Australia

http://news.bbc.co.uk/go/pr/fr/-/2/hi/science/nature/7101708.stm

Published: 2007/11/19 23:21:23 GMT

New research shows climate change triggers wars and population decline

Reduced agricultural productivity seems to initiate conflict

Climate change may be one of the most significant threats facing humankind. A new study shows that long-term climate change may ultimately lead to wars and population decline.

The study, published November 19 in the early edition of the journal Proceedings of the National Academy of Sciences (PNAS), revealed that as temperatures decreased centuries ago during a period called the Little Ice Age, the number of wars increased, famine occurred and the population declined.

Data on past climates may help accurately predict and design strategies for future large and persistent climate changes, but acknowledging the historic social impact of these severe events is an important step toward that goal, according to the study's authors.

"Even though temperatures are increasing now, the same resulting conflicts may occur since we still greatly depend on the land as our food source," said Peter Brecke, associate professor in the Georgia Institute of Technology's Sam Nunn School of International Affairs and co-author of the study.

This new study expands previous work by David Zhang of the University of Hong Kong and lead author of the study.

"My previous research just focused on Eastern China. This current study covers a much larger spatial area and the conclusions from the current research could be considered general principles," said Zhang.

Peter Brecke, associate professor in the Georgia Institute of Technology's Sam Nunn School of International Affairs, assembled a database of 4,500 wars worldwide and population data to show that long-term...
Click here for more information.

Brecke, Zhang and colleagues in Hong Kong, China and the United Kingdom perceived a possible connection between temperature change and wars because changes in climate affect water supplies, growing seasons and land fertility, prompting food shortages. These shortages could lead to conflict – local uprisings, government destabilization and invasions from neighboring regions – and population decline due to bloodshed during the wars and starvation.

To study whether changes in temperature affected the number of wars, the researchers examined the time period between 1400 and 1900. This period recorded the lowest average global temperatures around 1450, 1650 and 1820, each separated by slight warming intervals.

A new study in PNAS shows that reduced agricultural productivity caused by climate change triggers wars and population decline.
Click here for more information.

The researchers collected war data from multiple sources, including a database of 4,500 wars worldwide that Brecke began developing in 1995 with funding from the U.S. Institute of Peace. They also used climate change records that paleoclimatologists reconstructed by consulting historical documents and examining indicators of temperature change like tree rings, as well as oxygen isotopes in ice cores and coral skeletons.

Results showed a cyclic pattern of turbulent periods when temperatures were low followed by tranquil ones when temperatures were higher. The number of wars per year worldwide during cold centuries was almost twice that of the mild 18th century.

The study also showed population declines following each high war peak, according to population data Brecke assembled. The population growth rate of the Northern Hemisphere was elevated from 1400-1600, despite a short cooling period beginning in the middle of the 15th century. However, during the colder 17th century, Europe and Asia experienced more wars of great magnitude and population declines.

In China, the population plummeted 43 percent between 1620 and 1650. Then, a dramatic increase in population occurred from 1650 until a cooling period beginning in 1800 caused a worldwide demographic shock.

The researchers examined whether these average temperature differences of less than one degree Celsius were enough to cause food shortages. By assuming that agricultural production decreases triggered price increases, they showed that when grain prices reached a certain level, wars erupted. The ecological stress on agricultural production triggered by climate change did in fact induce population shrinkages, according to Brecke.

Global temperatures are expected to rise in the future and the world's growing population may be unable to adequately adapt to the ecological changes, according to Brecke.

"The warmer temperatures are probably good for a while, but beyond some level plants will be stressed," explained Brecke. "With more droughts and a rapidly growing population, it is going to get harder and harder to provide food for everyone and thus we should not be surprised to see more instances of starvation and probably more cases of hungry people clashing over scarce food and water."

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http://www.eurekalert.org/pub_releases/2007-11/giot-nrs112107.php

Scientists unravel plants' natural defenses

A team of researchers, led by the University of Sheffield and Queen Mary, University of London, has discovered how plants protect their leaves from damage by sunlight when they are faced with extreme climates. The new findings, which have been published in Nature, could have implications both for adapting plants to the threat of global warming and for helping man better harness solar energy. Photosynthesis in plants relies upon the efficient collection of sunlight. This process can work even at low levels of sunlight, when plants are in the shade or under cloud cover for example. However, when the sun is very bright or when it is cold or very dry, the level of light energy absorbed by leaves can be greatly in excess of that which can be used in photosynthesis and can destroy the plant. However, plants employ a remarkable process called photoprotection, in which a change takes place in the leaves so that the excess light energy is converted into heat, which is harmlessly dispersed.

Until now, researchers hadn't known exactly how photoprotection works. By joining forces with their physicist colleagues in France and the Netherlands, the UK team have determined how this process works. They were able to show how a small number of certain key molecules, hidden among the millions of others in the plant leaf, change their shape when the amount of light absorbed is excessive; and they have been able to track the conversion of light energy to heat that occurs in less than a billionth of a second. Many plant species can successfully inhabit extreme environments where there is little water, strong sunlight, low fertility and extremes of temperature by having highly tuned defence mechanisms, including photoprotection. However, these mechanisms are frequently poorly developed in crop plants since they are adapted for high growth and productivity in an environment manipulated by irrigation, fertilisation, enclosure in greenhouses and artificial shading. These manipulations are not sustainable, they have high energy costs and may not be adaptable to an increasingly unstable climate. Researchers believe that in the future, the production of both food and biofuel from plants needs to rely more on their natural defence mechanisms, including photoprotection.

Professor Horton, of the University of Sheffield's Department of Molecular Biology and Biotechnology, who lead the UK team, said: "These results are important in developing plants with improved photoprotective mechanisms to enable them to better cope with climate change. This may be hugely significant in our fight against global warming. It is a fantastic example of what can be achieved in science when the skills of biologists and physicists are brought together."Moreover, there are other global implications of this research. Dr Alexander Ruban of Queen Mary's School of Biological and Chemical Sciences, comments: "As we seek to develop new solar energy technology it will be important to not only understand, but to mimic the way biology has learnt to optimise light collection in the face of the continually changing intensity of sunlight."

Notes for editors:

The paper, Identification of a mechanism of photoprotective energy dissipation in higher plants, will be published in Nature on 22 November 2007.

The research project is a collaboration between the University of Sheffield, UK; Queen Mary, University of London, UK; the University of Amsterdam, Netherlands; the University of Wageningen, Netherlands; CEA Saclay and CNRS Gif-sur-Yvette, France.

The work was supported by grants from UK Biotechnology and Biological Sciences Research Council, the Netherlands Organization for Scientific Research via the Foundation of Earth and Life Sciences, Laserlab Europe; ANR, and the Marie Curie Research Training Network.

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http://www.eurekalert.org/pub_releases/2007-11/uos-sup112007.php

Don't judge a brook by its color -- brown waters are more natural

Over the last 20 years lakes and streams in remote parts of the UK, southern Scandinavia and eastern North America have been increasingly stained brown by dissolved organic matter. In this week's Nature journal (22 November) an international team, led by researchers from UCL (University College London) and the US Environmental Protection Agency (EPA), demonstrates that the colour change is indicative of a return to a more natural, pre-industrial state following a decline in the level of acid rain.

Don Monteith, Senior Research Fellow at the UCL Environmental Change Research Centre, says: "A huge amount of carbon is stored in the form of organic deposits in soils, and particularly in the peatlands that surround many of our remote surface waters. In the past two decades an increasing amount of this carbon has been dissolving into our rivers and lakes, turning the water brown.

"There have been numerous attempts to explain what's happening, with everything from global warming to changing land-use cited as the cause. Some studies have suggested that we're seeing an unprecedented phenomenon as soils destabilise with unpredictable consequences for the global carbon cycle."

John Stoddard of the EPA says: "By analysing water chemistry records from over 500 sites across the northern hemisphere we've found that the dominant factor in the whole process is not global warming. The most important driver has actually been the major reduction in acid rain since the 1970s. As acidity and pollutant concentrations in the soil fall, carbon becomes more soluble, which means more of it moves into our lakes and rivers and more can be exported to the oceans.

"In some ways we're seeing waters returning to their natural, pre-industrial state. However, more research is needed into the implications for freshwaters. The environmental pathways of heavy metals like aluminium and mercury, for example, are closely tied to dissolved organic carbon, and it's too early to know how increasing organic matter will affect these toxic compounds.

Chris Evans, from the UK Centre for Ecology and Hydrology, adds: "The suggestion that waters are returning to more natural conditions may be of little consolation to water supply companies as they are faced with the increasingly difficult - and expensive – task of removing the colour from drinking water using treatment facilities that were designed to deal with the lower concentrations experienced in previous years."

Data for this study was drawn from nationally funded monitoring programs in the UK, USA, Canada, Norway, Sweden and Finland. Trends in dissolved organic carbon, air temperatures and a suite of other chemical variables were assessed using data from 1990-2004. The study is the largest of its kind and the data represents the main source of high quality, long-term information about the condition of our headwater systems. Ironically many of the study sites, including those in the UK, are under threat of imminent closure or scaling back due to cuts in government funding. This comes despite increasing recognition of the urgent need to monitor the response of natural environments to climate change and other man-made pressures, and the obvious value of these records for increasing our understanding of environmental processes.

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Notes to editors:

About UCL:

Founded in 1826, UCL was the first English university established after Oxford and Cambridge, the first to admit students regardless of race, class, religion or gender, and the first to provide systematic teaching of law, architecture and medicine. In the government's most recent Research Assessment Exercise, 59 UCL departments achieved top ratings of 5* and 5, indicating research quality of international excellence.

UCL is in the top ten world universities in the 2007 THES-QS World University Rankings, and the fourth-ranked UK university in the 2007 league table of the top 500 world universities produced by the Shanghai Jiao Tong University. UCL alumni include Marie Stopes, Jonathan Dimbleby, Lord Woolf, Alexander Graham Bell, and members of the band Coldplay.

About the UCL Environmental Change Research Centre

The ECRC is one of UCL's major interdisciplinary research centres. It is based in the Department of Geography and conducts research on the effects of climate change and pollution on aquatic ecosystems (www.ecrc.ucl.ac.uk)

About the US Environmental Protection Agency

The U.S. EPA is the regulatory agency responsible for protecting the quality of the air and waters of the U.S. As part of its responsibilities, the EPA conducts extensive research on the effects of environmental pollutants on ecological and human well-being.

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http://www.eurekalert.org/pub_releases/2007-11/ucl-dja112007.php

DOE JGI plumbs termite guts to yield novel enzymes for better biofuel production

WALNUT CREEK, CA --- Termites -- notorious for their voracious appetite for wood, rendering houses to dust and causing billions of dollars in damage per year -- may provide the biochemical means to a greener biofuel future. The bellies of these tiny beasts actually harbor a gold mine of microbes that have now been tapped as a rich source of enzymes for improving the conversion of wood or waste biomass to valuable biofuels.

Nasutitermes corniger termites photographed in Puerto Rico.
Click here for more information.

The genomic sequencing and analysis of the termite gut microbes by the U.S. Department of Energy Joint Genome Institute (DOE JGI), the California Institute of Technology, Verenium Corporation (formerly Diversa), a biofuels company, INBio, the National Biodiversity Institute of Costa Rica, and the IBM Thomas J. Watson Research Center, are highlighted in the November 22 edition of the journal Nature.

"The termite is a remarkable machine," said Dr. Raymond L. Orbach, Under Secretary for Science, U.S. Department of Energy, whose program supports DOE JGI. "Termites can digest a frightening amount of wood in a very short time, as anyone who has had termites in their house is painfully aware. Instead of using harsh chemicals or excess heat to do so, termites employ an array of specialized microbes in their hindguts to break down the cell walls of plant material and catalyze the digestion process. Industrial-scale DNA sequencing by DOE JGI was key to identifying the genetic structures that comprise the tools that termites use. Our task now is to discover the metabolic pathways generated by these structures to figure out how nature digests plant materials. We can then synthesize the novel enzymes discovered through this project to accelerate the delivery of the next generation of cellulosic biofuels."

While termites have been the subject of keen scientific study for more than a century, the precise identity and role of the microbes from their digestive tract remained a mystery. With this new work, the symbiotic orchestration of these compartmentalized, complex microbial communities required for wood digestion is now coming to light.

Like cows, termites have a series of stomachs, each harboring a distinct community of microbes under precisely defined conditions. These bugs within bugs are tasked with particular steps along the conversion pathway of woody polymers to sugars that can then be fermented into fuels such as ethanol. The mandibles of the insect chomp the wood into bits, but the real work is conducted in the dark recesses of the belly, where the enzymatic juices exuded by microbes attack and deconstruct the cellulose and hemicellulose, which, along with lignin, are the basic building blocks of wood.

Nasutitermes corniger termites photographed in Puerto Rico.

Click here for more information.

The tiny insects that gave up their stomach contents to advance the frontiers of science were isolated on a safari into the rainforest of Costa Rica, the world's geographic hotbed of biodiversity for termites, by co-author Jared Leadbetter of Cal Tech, first author Falk Warnecke of DOE JGI's Microbial Ecology Program, and members of Verenium and INBio. Traipsing through the jungle, the team came upon a massive, tumor-like nest of termites clinging to an otherwise nondescript tree. With a flick of a machete, the contents of this dense network of tunnels forged from wood waste were revealed, along with a frenzy of higher termites from the genus Nasutitermes, which are only about the size of the date imprinted on a penny.

Foregoing the funnel-headed "soldiers," the project focused on the larger "workers," with bulbous heads and inflated bellies. In the laboratory of INBio, researchers armed with fine forceps and needles painstakingly extracted the contents of the workers' third paunch or hindgut, referred to as P3, a distended kink in the convoluted plumbing system of the termite. Each sample was barely visible to the naked eye, and care was taken not to contaminate it with material from neighboring stomachs. Contents from 165 specimens were purified, yielding only a few valuable drops -- a veritable microbial mosh pit -- that was sent on ice to Verenium for DNA extraction and preparation, then on to DOE JGI's Walnut Creek (CA) Production Genomics Facility for sequencing.

From the sample, about 71 million letters of fragmented genetic code were elaborated and computationally reassembled, like putting Humpty Dumpty back together again, to tease out the identities of the microbial players in the mixture and the metabolic profile of the enzymes that they produce. From this reconstructed liquid puzzle emerged the identities of a dozen different phyla -- broad groupings of microbial life forms.

"Our analysis revealed that the hindgut is dominated by two major bacterial lineages, treponemes and fibrobacters," said co-author Phil Hugenholtz, DOE JGI's Microbial Ecology Program head. "Treponemes have long been recognized in the termite gut due to their distinctive cork-screw shape, but fibrobacters were an exciting new find, because they have relatives in the cow rumen known to degrade cellulose. We could directly link the termite fibrobacters and treponemes to enzymes capable of breaking down wood. However, fibrobacters are specialists in this regard and don't appear to participate in sugar fermentation, leaving that to the treponemes. This project has really given me a new appreciation for the lowly termite, a mobile miniature bioreactor."

In the termite P3 compartment alone, more than 500 genes related to the enzymatic deconstruction of cellulose and hemicellulose were identified by Hugenholtz and colleagues. This dataset has since been uploaded by DOE JGI onto its metagenome data management and analysis system, IMG/M (http://img.jgi.doe.gov/) for public access and further analysis.

"Adapting these findings for an industrial-scale system is far from easy," said Eddy Rubin, JGI Director. "Termites can efficiently convert milligrams of lignocellulose into fermentable sugars in their tiny bioreactor hindguts. Scaling up this process so that biomass factories can produce biofuels more efficiently and economically is another story. To get there, we must define the set of genes with key functional attributes for the breakdown of cellulose, and this study represents an essential step along that path."

Nature paper first author Falk Warnecke is a postdoctoral fellow in the Hugenholtz lab. Other DOE JGI authors include Natalia Ivanova, Rotem Sorek, Susannah Tringe, Hector Garcia Martin, Victor Kunin, Daniel Dalevi, Julita Madejska, Edward Kirton, Darren Platt, Ernest Szeto, Asaf Salamov, Kerrie Barry, Natalia Mikhailova, Nikos Kyrpides, and Director Rubin.

DOE Joint Genome Institute researchers and Nature termite paper authors.

Click here for more information.

These findings follow on the heels of the announcement by DOE Secretary Samuel Bodman in June that DOE will invest up to $375 million in three new Bioenergy Research Centers (http://genomicsgtl.energy.gov/centers/) to accelerate basic

The termite hindgut whodunit builds upon DOE JGI's pioneering "metagenomic" research, where genetic material is isolated, identified, and characterized directly from environmental samples, providing a profile of a particular (often extreme) ecological niche. Published investigations by DOE JGI include glimpses into such diverse slices of the biosphere as acid mine drainage, a gutless worm,

Currently among the scores of projects in the sequencing queue at DOE JGI are metagenomes from contents of the Tammar wallaby forestomach, the Asian longhorned beetle gut, and other exotic species that promise to be treasure troves of enzymes involved in cellulose deconstruction. These targets were submitted through DOE JGI's Community Sequencing Program (CSP), which provides the scientific community with access to high-throughput sequencing for projects of relevance to DOE missions.

The U.S. Department of Energy Joint Genome Institute, supported by the DOE Office of Science, unites the expertise of five national laboratories -- Lawrence Berkeley, Lawrence Livermore, Los Alamos, Oak Ridge, and Pacific Northwest -- along with the Stanford Human Genome Center to advance genomics in support of the DOE missions related to clean energy generation and environmental characterization and cleanup. DOE JGI's Walnut Creek, CA, Production Genomics Facility provides integrated high-throughput sequencing and computational analysis that enable systems-based scientific approaches to these challenges. Additional information about DOE JGI can be found at: http://www.jgi.doe.gov/.

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http://www.eurekalert.org/pub_releases/2007-11/dgi-djp111907.php

Carnivorous plants use pitchers of 'slimy saliva' to catch their prey

Carnivorous plants supplement the meager diet available from the nutrient-poor soils in which they grow by trapping and digesting insects and other small arthropods. Pitcher plants of the genus Nepenthes were thought to capture their prey with a simple passive trap but in a paper in this week's PLoS ONE, Laurence Gaume and Yoel Forterre, a biologist and a physicist from the CNRS, working respectively in the University of Montpellier and the University of Marseille, France show that they employ slimy secretions to doom their victims. They show that the fluid contained inside the plants'

Since Charles Darwin's time, the mechanism of insect-trapping by Nepenthes pitcher plants from the Asian tropics has intrigued scientists but is still incompletely understood. The slippery inner surfaces of their pitchers have – until now – been considered the key trapping devices, while it was assumed that the fluid secretions were only concerned with digestion. Gaume and Forterre were able to combine their separate expertise in biology and physics to show that the digestive fluid of Nepenthes rafflesiana

The pair took high-speed videos of flies and ants attempting to move through plants' fluid. Flies quickly became completely coated in the fluid and unable to move even when diluted more than 90% with water. Physical measurements on the fluid showed that this was because this complex fluid generates viscoelastic filaments with high retentive forces that give no chance of escape to any insect that has fallen into it and that is struggling in it. That the viscoelastic properties of the fluid remain strong even when highly diluted is of great adaptive significance for these tropical plants which are often subjected to heavy rainfalls.

For insects, this fluid acts like quicksand: the quicker they move, the more trapped they become. Its constituency is closely akin to mucus or saliva, which, in some reptiles and amphibians, serves a very similar purpose. The exact makeup of this fluid, apparently unique in the plant kingdom, remains to be determined; however, it may point the way to novel, environmentally friendly approaches to pest control.

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Citation: Gaume L, Forterre Y (2007) A Viscoelastic Deadly Fluid in Carnivorous Pitcher Plants. PLoS ONE 2(11): e1185. doi:10.1371/journal.pone.0001185

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New microscope peers into secret lives of cells

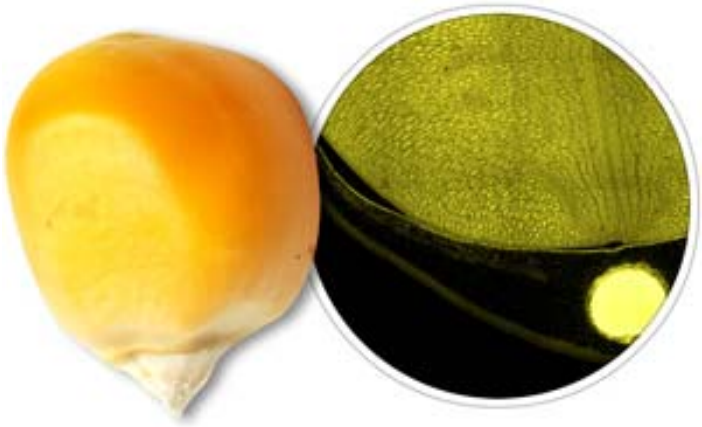
Kirk Czymmek, director of UD's Bio-Imaging Center, with the new laser-scanning confocal microscope.
1:54 p.m., Nov. 19, 2007--“See those white sparks?” asks Kirk Czymmek, as he points to the video on his computer screen of a highly magnified heart cell in action. Tiny fireworks flash across the screen with every pulsation of the cell.

“That's calcium,” Czymmek notes. “Scientists have discovered that there is a large release of calcium with every heartbeat. If we don't see those sparks,” he notes, “you have a major problem--perhaps even heart failure.”

Czymmek has a bird's-eye view into the fascinating and rarely seen world of the microscopic, as director of the University of Delaware's Bio-imaging Center.

The center, a component of UD's Delaware Biotechnology Institute, is equipped with the latest technology for microscopic explorations into a diversity of intriguing subjects under investigation by University researchers, from plants that can decontaminate soils of toxic metal pollutants, to carbon nano-bombs for destroying cancer cells.

Czymmek, who also is an associate professor of biological sciences at UD, recently showcased the latest addition to the University's suite of high-tech imaging tools--a state-of-the-art laser-scanning confocal microscope. UD is among a handful of universities that own one of the million-dollar instruments.



Look inside a corn kernel and see the individual cells.

The device, known as the LSM 510 DUO, manufactured by Carl Zeiss MicroImaging Inc., typically uses a laser beam to observe a single focal point at a time on its subject--acquiring over a quarter-million picture elements, or pixels, in a single scan, which takes about one second. However, if the laser beam is shaped into a line and swept across the sample, it can scan an image over 100 times faster.

The microscope is particularly useful in examining thick samples such as muscle tissue at high resolution, Czymmek says, because a series of scans may be made at different depths within the sample and assembled automatically in minutes, yielding breathtakingly detailed, three-dimensional images, much like an MRI of the human body reveals.

"It has been my experience, that advances in analytical science often open the door to new scientific inventions and innovations," said David Weir, director of the Delaware Biotechnology Institute. "The capability we now have with this new microscope, which allows us to observe natural processes as they occur and in great detail, will surely result in new, important discoveries."

Currently, Czymmek and his staff--associate scientist Liz Adams and research associates Deborah Powell and Shannon Modla--are assisting UD researchers with a broad range of scientific projects on plants and fungi, vocal cords, bone health, biofilms, DNA repair, and gel-like synthetic polymers, among others.

An average of 175 users per year have been served at the center since it opened in 2001, according to Czymmek. UD faculty, staff and students, as well as research collaborators from industry and governmental agency partners, have all been trained in the safe and proper operation of the center's sophisticated "eyes."

UD's Bio-Imaging Center also is an important resource for scientists beyond Delaware's borders, with colleagues from the National Institutes of Health, Johns Hopkins University, DuPont, Georgetown University, Merck and Virginia Commonwealth University attending microscopy training workshops hosted by Czymmek and his staff.

Czymmek, who refers to himself as a "jack of all trades," has been using confocal microscopes on almost a daily basis since 1990 when they helped illuminate his doctoral studies of plant diseases and fungi.

One of the things he most likes about his position at UD is its cross-disciplinary focus. He has assisted scientists in examining the hard exoskeleton of an insect, for example, to learn how to make new and improved materials.

"I like being able to help tie together the biology and engineering and help people figure out the best way to solve a problem," he says.

With each new and improved tool for revealing hidden worlds, Czymmek and his staff gain a front-row seat into the formerly unknown and help put dozens of UD research studies literally into sharper focus.

"It's kind of like going out in space," Czymmek says with a smile. "We get to see things that no one else has ever seen before."

The Bio-imaging Center is open to UD researchers and collaborators on a fee-for-service basis. For more information, visit the center's Web page at [www.dbi.udel.edu/bioimaging/index.html].

Article by Tracey Bryant
Photo by Kathy F. Atkinson

http://www.udel.edu/PR/UDaily/2008/nov/confocal111907.html

Watching what we eat: Food systems in Europe

Food has never been more of a global commodity than it is today. But there is an urgent need to understand the problems that face future European food supplies within this global market. And so scientists and policy makers gathered in Budapest last week to push for a more holistic approach to the study of what Europeans eat.

The conference, supported by the European Science Foundation (ESF) and the European Cooperation in the field of Scientific and Technical Research (COST), looked at where food comes from, the ways in which it is processed, packaged and distributed, and how it is sold and eventually eaten.

Scientists at the conference showed that Europeans sitting down at their dinner tables are eating a broader range of meats and vegetables than ten years ago. Europeans demand that their food tastes better, makes them healthier and can be prepared in less time, and yet they want this food available year round at a low price. To meet these needs, food travels many more miles; along much more complicated distribution routes than ever before on its journey from the farm to our forks.

“This requires a new approach to describing food supply. We're advocating a food systems approach”, says Thomas Henrichs, a senior advisor for the National Environment Research Institute in Denmark. “The food systems approach includes not only the activities involved in food supply, such as growing and processing a green bean and packing it for distribution, and shipping it, but also the outcomes of eating the green bean on the environment, on the economy and on the health and welfare of the person eating it”, explains Henrichs.

One reason to better understand the European food system is the growth in global markets—the Chinese are eating more meat, and a large market for dairy products is opening up on the Indian subcontinent. “Until recently, Europe has invested intensively in its food system in relative isolation”, explains Rudy Rabbinge, professor in sustainable development and food systems at Wageningen University in the Netherlands. “But Europe must change its food system to take advantage of these new markets”, he says.

And with Europe’s share of global exports predicted to drop from 24 percent to 20 percent over the next 10 years, Europe needs to become more efficient to compete in a global market. Scientists hope that by encouraging different industries within the food chain to think about the food system as a whole, they can increase overall efficiency.

Changes to Europe’s own food market is another reason to better understand the European food system. An aging European population brings different health demands that could be met—in part—by altering the food they eat. Migration of people into the EU has changed European food tastes, customs and traditions, and increased wealth gives Europeans the means to buy more meat. Furthermore, longer workdays and the entry of women into the workplace has left many Europeans with little time to prepare food, resulting in a reliance on ‘ready-meals’. One consequence of this is an average meal contains more ingredients that have travelled further and require more packaging.

Finally, changing energy consumption and the threat of climate change will force Europeans to think about how efficiently they produce and consume food. By studying food systems, scientists hope to understand the socioeconomic, political, and cultural influences on what Europeans eat. And policy makers can use this knowledge to steer how Europe manages the food chain—starting in the field and ending in the stomach—to ensure that all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs.

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The conference, on November 5-6, was attended by 75 scientists and policy makers from 22 countries and was one of the series of research conferences organised by the ESF-COST Forward Look

initiative. Forward Look, a flagship instrument of the ESF, allows scientists to meet people from the world of policy and help set priorities for future research.

This Forward Look is a multidisciplinary joint ESF/COST initiative, which involves the ESF Standing Committee for Life, Earth and Environmental Sciences (LESC), the ESF European Medical Research Councils (EMRC), the ESF Standing Committee for the Humanities (SCH), the ESF Standing Committee for the Social Sciences (SCSS) and the COST Domain Committee for Food and Agriculture (FA).

http://www.eurekalert.org/pub_releases/2007-11/esf-www111607.php

New evidence for female control in reproduction

WASHINGTON, D.C. — Adding another layer of competition to the mating game, scientists are reporting possible biochemical proof that the reproductive system of female mammals can "sense" the presence of sperm and react to it by changing the uterine environment. This may be the molecular mechanism behind post-copulatory sexual selection, in which females that have mated with several partners play a role in determining which sperm fertilizes their egg.

Lead author Alireza Fazeli says that the deep new molecular insights into this post-coital "ladies' choice" has profound implications for in-vitro fertilization (IVF), cloning, and animal breeding. It is also a windfall for evolutionary biology, providing a possible explanation for female promiscuity in the animal kingdom, he adds.

In a first-of-its-kind study scheduled for ACS' Journal of Proteome Research, Fazeli's international scientific team reports the first chemical evidence of a sperm recognition system in the oviducts of pigs — standard animals for such research because their reproductive systems are similar to humans.

In the traditional view, competition for the egg is male-oriented, with sperm themselves deciding which fertilizes the egg by being the faster swimmer. With post-copulatory sexual selection, the female is in control, her oviducts selecting the "winner"— the best quality sperm from the healthiest male — and rejecting the rest.

"This study clearly shows that the sperm's arrival in the female reproductive tract triggers a cascade of changes that leads to alteration of protein production in the oviduct and a change in the oviductal environment. We speculate that this is mainly done to prepare oviduct environment for storing sperm, fertilization and early embryonic development," Fazeli said. However this can also be used as a detection and selection system that alerts females to the presence of different kinds of sperm and then triggers mechanisms in the oviducts that control sperm transport, binding and activation for fertilization.

"We know sperm selection exists in nature, especially in promiscuous species, when females mate with several males," Fazeli said. "Baboons are a good example. During one reproductive cycle, if the female mates with several males, most of the time the offspring belong to one of the males — not a spread between all of them… We are now seeing what can be the molecular basis for this effect."

While sperm interaction with oviduct cells has been studied in laboratory cultures, the new research is the first to provide evidence for this poorly-understood process in living animals, Fazeli said. Using minimally invasive techniques, the researchers compared protein changes in the oviductal fluids before and after sperm introduction to the reproductive tract.

The data shows that the mammalian female reproductive tract is a far more tightly regulated environment than once thought — a fact that Fazeli says is "nearly completely ignored by modern IVF." He believes the new findings have profound implications for the massive IVF industry, which has grown exponentially in the past 25 years, as well as cloning. Both techniques rely on egg fertilization outside of their finely-tuned reproductive environment.

"The female reproductive tract is a very highly organized and regulated system," Fazeli explained. "With IVF, the embryo can develop into an adult, but the question remains: 'Are we doing the fine-tuning right'? We are not sure if what we are doing, based on differences between in-vitro and in-vivo fertilization, is creating health problems for these babies."

Applications for this research extend into agricultural animal breeding, since it has the potential to improve fertilization rates and reproductive techniques in livestock.

Fazeli suggests that the work his team is doing is also applicable to the artificial insemination industry. Some of the products that a female's oviducts produce in response to sperm are meant to store and

keep the sperm alive. This may be an aspect of post-coital sexual selection since sperm may remain viable in the human female's reproductive tract for nearly five days. Other female animals sustain sperm for even longer periods—bats can do so for up to six months.

Fazeli said that another aspect of this work relates to understanding the mechanisms involved in determination of self and non-self by the immune system. Since sperm are a foreign entity in the female reproductive tract, the immune system should attack and destroy them. In reality, however, sperm are protected and stored.

The traditional explanation is that sperm somehow evade the immune response. Fazeli says his data shows that this is not true. He found that the female immune system instead recognizes sperm as a friend, not a foe. Fazeli suggests that the female reproductive tract is equipped with sensory systems that recognize sperm and alert the ancient, non-specific "innate" immune system to dampen its reaction towards them.

"The main message from this work is that the female reproductive tract has a lot more control than previously thought," says Fazeli. "This discovery profoundly influences our understanding of the physiology of events leading to conception and the bearing of offspring."

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The American Chemical Society — the world's largest scientific society — is a nonprofit organization chartered by the U.S. Congress and a global leader in providing access to chemistry-related research through its multiple databases, peer-reviewed journals and scientific conferences. Its main offices are in Washington, D.C., and Columbus, Ohio.

Paper:
"Modulation of the Oviductal Environment by Gametes"

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Remains of ancient synagogue with unique mosaic floor found in Galilee

Jerusalem, Nov. 21, 2007 – Remains of an ancient synagogue from the Roman-Byzantine era have been revealed in excavations carried out in the Arbel National Park in the Galilee under the auspices of the Hebrew University of Jerusalem.

The excavations, in the Khirbet Wadi Hamam, were led by Dr. Uzi Leibner of the Hebrew University's Institute of Archaeology and Scholion – Interdisciplinary Research Center in Jewish Studies.

Dr. Leibner said that the synagogue's design is a good example of the eastern Roman architectural tradition. A unique feature of the synagogue is the design of its mosaic floor, he said.

The synagogue ruins are located at the foot of the Mt. Nitai cliffs overlooking the Sea of Galilee, amidst the remains of a large Jewish village from the Roman-Byzantine period. The first season of excavations there have revealed the northern part of the synagogue, with two rows of benches along the walls. The building is constructed of basalt and chalk stone and made use of elements from an earlier structure on the site.

Mosaic floor found at site of newly discovered Galilee synagogue shows workman with woodworking tool.
Click here for more information.

Archaeologists differ among themselves as to which period the ancient Galilean synagogues belong. The generally accepted view is that they can be attributed to the later Roman period (second to fourth centuries C.E.), a time of cultural and political flowering of the Jews of the Galilee. Recently, some researchers have come to believe that these synagogues were built mainly during the Byzantine period (fifth and sixth centuries C.E.), a time in which Christianity rose to power and, it was thought, the Jews suffered from persecution. Dr. Leibner noted that this difference of scholarly opinion has great significance in perhaps redrawing the historical picture of Jews in those ancient times.

The excavators were surprised to find in the eastern aisle of the synagogue a mosaic decoration which to date has no parallels -- not in other synagogues, nor in art in Israel in general from the Roman-Byzantine period. The mosaic is made of tiny stones (four mm. in size) in a variety of colors. The scene depicted is that of a series of woodworkers who are holding various tools of their trade. Near these workers is seen a monumental structure which they are apparently building. According to Dr. Leibner, since Biblical scenes are commonly found in synagogue art, it is possible that what we see in this case is the building of the Temple, or Noah's ark, or the tower of Babel. The mosaic floor has been removed from the excavation site and its now in the process of restoration.

The archaeologists at the site are also attempting, though their excavations, to gain a clearer picture of rural Jewish village life in Roman-era Galilee. In addition to excavating the synagogue, they also are involved in uncovering residential dwellings and other facilities at the site, such as a sophisticated olive oil press and solidly-built two-story homes.

"There are those who tend to believe that the rural Jewish villagers of that era lived in impoverished houses or in huts and that the magnificent synagogues existed in contrast to the homes that surrounded them," said Dr. Leibner. 'While it is true that the synagogues were built of a quality that exceeded the other structures of the village, the superior quality private dwellings here testify to the impressive economic level of the residents."

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Participating in the excavations were students from the Hebrew University Institute of Archaeology, Jewish youth groups from abroad and many other volunteers.

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http://www.eurekalert.org/pub_releases/2007-11/thuo-roa112107.php

Digging biblical history, or the end of the world

Some come to dig the Tel Aviv University-directed archeological site at Tel Megiddo because they are enchanted by ancient stories of King Solomon. Others come because they believe in a New Testament prophecy that the mound of dirt will be the location of a future Judgment Day apocalyptic battle. Hence the second, rather more chilling name for the site: "Armageddon."

Tel Megiddo has been the subject of a number of decisive battles in ancient times (among the Egyptian, Hebrew and Assyrian peoples) and today it holds a venerated place in archaeology, explains site co-director and world-renowned archeologist Prof. Israel Finkelstein.

Says Prof. Finkelstein, from the Department of Archaeology and Ancient Near Eastern Cultures at Tel Aviv University, "Megiddo is one of the most interesting sites in the world for the excavation of biblical remains. Now volunteers and students from around the world can participate in the dig which lets them uncover 3,000 years worth of history -- from the late 4th millennium B.C.E. to the middle of the first millennium C.E."

Prof. Finkelstein, who belongs to the Sonia and Marco Nadler Institute of Archaeology at Tel Aviv University, has been co-directing the site with Prof. David Ussishkin, also of Tel Aviv University, since 1994.

Professor Israel Finkelstein
Click here for more information.

Prof. Finkelstein has co-authored a best-selling book on archaeology and biblical history (The Bible Unearthed, 2001). Earlier this month he released a book (written with A. Mazar) that contains surprising commentary on biblical archaeology and history, The Quest for Biblical Archeology, published by the Society of Biblical Literature in the United States. He is also the recipient of the prestigious international Dan David Prize in the category of Past Dimension (2005).

Likened to a "lightening rod" by the journal Science (2007), Prof. Finkelstein is famous for his unconventional way of interpreting biblical history: he puts emphasis on the days of the biblical authors in the 7th century B.C.E. and theorizes that ancient rulers such as David and Solomon, who lived centuries earlier, were "tribal chieftains ruling from a small hill town, with a modest palace and royal shrine."

Yet, "new archaeological discoveries should not erode one's sense of tradition and identity," he states.

Prof. Ze'ev Herzog, who heads the archaeology institute at Tel Aviv University, says, "There has been an important revolution in biblical history in the last decades. We are now uncovering the difference between myth and history, and between reality and ideology of the ancient authors. This is the role of our generation of archaeologists -- to unearth the real historical reality to find out why and how the biblical records were written."

At the Megiddo Dig: A general view of early Bronze Age temples
Click here for more information.

The archeologists aren't the only ones looking for answers. More than one hundred volunteers come from all corners of the world to dig Megiddo alongside Prof. Finkelstein every year. They are teachers, journalists, actors, construction workers, professors and housewives, as well as archaeology, history and divinity students who dig for credit.

The Megiddo dig is offered as a three-week, four-week or seven-week program. As part of the experience, volunteers live in a nearby kibbutz and are exposed to lectures and debates about their findings. The dig is partnered with the George Washington University, represented by Prof. Eric Cline, the American associate director of the dig. This makes it an ideal stomping ground for Americans who want a hands-on education in archaeology.

"Team and staff members come from all around the world for many reasons: the adventure of foreign travel in a safe yet educational environment, intellectual stimulation, and -- yes -- even a love of digging in the dirt," notes Prof. Finkelstein.

And those with no prior knowledge or degrees are welcome, he stresses. "We cater to all of the volunteers' backgrounds and teach them field methods, archeological techniques as well as the history of biblical archeology. It is truly a wonderful experience."

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http://www.eurekalert.org/pub_releases/2007-11/afot-dbh112007.php

Human ancestors: more gatherers than hunters?

Early humans may have dug potato-like foods with tools, say anthropologists from USC, UC San Diego and UW-Madison

Chimpanzees crave roots and tubers even when food is plentiful above ground, according to a new study that raises questions about the relative importance of meat for brain evolution.

Appearing online the week of Nov. 12 in the early edition of the Proceedings of the National Academy of Sciences, the study documents a novel use of tools by chimps to dig for tubers and roots in the savanna woodlands of western Tanzania.

The chimps' eagerness for buried treats offers new insights in an ongoing debate about the role of meat versus potato-like foods in the diet of our hominid ancestors, said first author Adriana Hernandez-Aguilar, who collected the field data for her doctoral research at the University of Southern California.

The debate centers on the diet followed by early hominids as their brain and body size slowly increased towards a human level. Was it meat-and-potatoes, or potatoes-and-meat"

"Some researchers have suggested that what made us human was actually the tubers," Hernandez-Aguilar said.

Anthropologists had speculated that roots and tubers were mere fallback foods for hominids trying to survive the harsh dry season in the savanna 3.5 million years ago and later (hominids are known to have consumed meat at least as early as 2.5 million years ago).

But the study found that modern chimps only dig for roots during the rainy season, when other food sources abound.

The finding suggests, but does not prove, that hominids behaved the same way. Researchers view modern chimps as proxies for hominids because of similarities in habitat, brain mass and body size.

"We look at chimps for the way that we could have behaved when our ancestors were chimp-like," Hernandez-Aguilar said.

Corresponding author Travis Pickering, of the University of Wisconsin-Madison, said: "Savanna chimps, we would contend, are dealing with environmental constraints and problems – evolutionary pressures – that our earliest relatives would have dealt with as well."

The tuber-digging chimps "suggest that underground resources were within reach of our ancestors," added co-author James Moore of the University of California at San Diego.

The study was based on observation of 11 digging sites in the Ugalla savanna woodland of western Tanzania.

Chimpanzees were linked to the excavated tubers and roots through knuckle prints, feces, and spit-out wads of fibers from those underground foods.

Seven tools were found at three of the sites, with worn edges and dirt marking implying their use as digging implements.

Because chimpanzees in the area are not habituated to humans, Hernandez-Aguilar was unable to observe them directly. She plans to conduct further observations in the area and to advocate for greater protection for the savanna chimps.

"Chimpanzees in savannas have not been considered a priority in conservation plans because they live in low densities compared to chimps in forests," she said.

"We hope that discoveries such as this will show the value of conserving the savanna populations."

Hernandez-Aguilar conducted her thesis work under Craig Stanford, professor of anthropology at USC.

###

The research was funded by the LSB Leakey Foundation, the National Science Foundation, the Jane Goodall Center at the University of Southern California, the University of California Committee on Research, the Palaeontology Scientific Trust and the Ugalla Primate Lab from UCSD. James Moore is the coordinator of the Ugalla Primate Project.

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Secrets in rare cartography

AGS library puts UWM on the 'library' map

Whales were the economic drivers of the 1850s. So important was this resource that the founder of the U.S. Oceanographic Office, Matthew Fontaine Maury, created a map showing the worldwide distribution of sperm and right whales in 1851.

"Whale oil then was like petroleum is today," says Christopher Baruth. "This is a graphic device that showed where the whales were located by type and season."

Baruth is curator of the American Geographical Society (AGS) Library, where a copy of the whale map is one of thousands of rare cartographical materials and geographical photographs.

Quietly housed at the University of Wisconsin-Milwaukee (UWM) since 1978, the AGS Library contains more than a million items, half of which are maps and charts, some dating to 15th century, and some that aren't available anywhere else, even at the Library of Congress.

The value of the items in the AGS collections is compounded by their connection to the society. AGS is the oldest national geographical society in the United States, founded in 1851 in New York City.

The Mappamundi, the oldest original map in the AGSL holdings, was produced in 1452 by the Venetian cartographer Giovanni Leardo. The circular map, considered the finest example of a medieval... Click here for more information.

Explorer-members, such as Charles Lindbergh, Robert Peary and Theodore Roosevelt, are among those who donated items associated with their exploits to the society over the years. Materials in the collection have been consulted not only by scholars, but also by the U.S. government during and at the end of both world wars. Today, it attracts scholars from as far away as Uzbekistan.

"It's a national treasure," says Robert McColl, professor emeritus of geography and East Asian studies at the University of Kansas, who in 2000 donated to AGSL his own geographical library, one of the best personal collections of Chinese materials in the world.

Stories of intrigue

McColl is one of the many travelers and scholars who, in addition to the famous, have helped build the collection.

"I went to China early enough that I found some items that are terribly unique, that might have disappeared otherwise," says McColl. Through his contacts in China, he found many works and maps that might have been produced in limited quantities or pulled off the market." He also found rare books, sometimes bound in silk, in flea markets. "People were selling them for food," he says.

It's like that with the contents of the AGSL, says Baruth. Each piece testifies to the adventurers, rare circumstances and history behind them – with as much intrigue as any work of fiction found in the other stacks of the UWM Libraries.

Notable contents include a wide range of materials, from black-and-white renderings done by hand to digital spatial data, from turn-of-the-century photographs of arctic exploration to charts used by Charles Lindbergh to fly from New York to Paris in 1927.

Chicago Festival of Maps

When asked to choose a "Top 10" from the collection, Baruth shakes his head slowly and replies, "That's like asking you to rank your children."

But three of the library's possessions are on view (http://www.uwm.edu/Libraries/AGSL/festivalmaps.html) at the Field Museum in Chicago, where the World Festival of Maps is hosting what many consider to be one of the greatest map exhibits of the century, "Maps: Finding Our Place in the World." In addition to the whale map described above, two more AGS holdings stand alongside cartographic gems from around the world at the exhibit, which runs through Jan. 27, 2008.

One is a unique manuscript map from about 1910 of the Belcher Islands in Hudson Bay. It was drawn from memory on the back of a missionary lithograph by an Inuit named Wetalltok, and given to Robert J. Flaherty, who created the film "Nanook of the North." It is the most accurate map of the islands then extant.

The other item on loan is the Mappamundi, the oldest original map in the AGSL holdings, produced in 1452 by the Venetian cartographer Giovanni Leardo. The circular map, considered the finest example of a medieval wall map in the Western Hemisphere, shows the known world consisting of only Europe, Asia and Africa, a configuration Baruth calls a T-O map. ("Imagine a capital ' T' inside a circle separating the three continents.")

As in many medieval maps, Jerusalem is situated in the center of the Mappamundi, and the names of regions were copied from those of a second-century geographer named Claudius Ptolemy. As the Age of Discovery advanced, Ptolemy's original work was filled in and expanded by explorers, spawning new editions called "novae tabulae."

AGSL has many such editions of these "Ptolemys," including a rare original from 1478 that was printed on vellum (animal skin).

Catalog incomplete

In the mid-1970s the AGS could no longer afford to archive its holdings and chose UWM to house the collection after a national search. It took nearly five years to orchestrate the move and surmount the legal challenges.

And Baruth concedes that riches may still lie hidden in the holdings.

In the library's more recent history, Baruth unearthed two prizes from the wall-length bookshelf in his own office: a first-edition copy of "Moby-Dick" by Herman Melville and a travel book given to the AGS by a young Teddy Roosevelt. Neither was found in the catalog at the time.

UWM Professor Bruce Fetter began specializing in both cartography and demography soon after UWM acquired the collection to better make use of the resource. He has been teaching a class on how to use the collection for 26 years.

"This material is essential because it affects how we see the world," says Fetter. "It is a wonderful way of getting a picture of the past."

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AGSL at a glance:

- More than a million total items.
- Oldest original is the Mappamundi, made in 1452 by the Venetian cartographer Giovanni Leardo.
- A half-million maps and charts, including four manuscript charts of the Australian voyages of Captain James Cook, 1770.
- More than 9,000 atlases, including an original 15th century Rome edition of Ptolemy's Geographia.
- 110 globes, including a 1613 globe done by Jodocus Hondius.
- Thousands of rare books and lithographs, including a copy of the first published world geography from the 15th century and a first-edition copy of "Moby-Dick."
- Hundreds of thousands of photographs and slides, including early expeditions (both doomed and successful) to the polar regions.

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http://www.eurekalert.org/pub_releases/2007-11/uow--sir112007.php

Football game days tops for drinking among college students

AUSTIN, Texas—College students drink larger amounts of alcohol on football game days, comparable to well-known drinking days such as New Year's Eve and Halloween, according to research from The University of Texas at Austin.

Psychologists found those women, particularly lighter drinkers, were more likely to engage in risky behaviors following alcohol consumption. The study appears in the November issue of Addictive Behaviors.

"Most events associated with heavy drinking occur only once a year, such as Spring Break, or once in a lifetime, such as a 21st birthday, but the weekly football schedule presents students with more regular opportunities to drink," said psychologist Kim Fromme, an author of the paper and director of the university's Studies on Alcohol, Health and Risky Activities Laboratory.

Fromme and co-author Dan J. Neal of Kent State University tracked students during the 2004-05 and 2005-06 University of Texas at Austin football seasons, the latter of which culminated in a national championship for the school.

The researchers found students were especially likely to drink more during high-profile games against conference or national rivals. However, the increased drinking rates only occurred when students were on campus. For instance, drinking levels were high for the 2005 regular-season Ohio State game, but were relatively low for games against rival Texas A&M (played during Thanksgiving break) and both Rose Bowl games, including the national championship (played during the semester break).

"These results indicate drinking is connected not only to the game itself, but to the social context associated with the event," Fromme said.

The study, funded by the National Institute of Alcohol Abuse and Alcoholism, is the first to track drinking patterns across an entire sports season.

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http://www.eurekalert.org/pub_releases/2007-11/uota-fgd111607.php

Too Few Women Scientists Achieving Academic Leadership Positions, According to Editorial in DNA and Cell Biology

New Rochelle, November 16, 2007 – As the U.S. continues to fall behind countries such as China and India in producing high-level scientists, one immediate and obvious solution would be to take advantage of the many women who have obtained doctoral degrees in science but have been passed over in their attempts to rise to the position of tenured professor, according to a provocative editorial in the November 2007 issue (Volume 26, Number 11) of ***DNA and Cell Biology***, a peer-reviewed journal published by **Mary Ann Liebert, Inc.** Click here to access the editorial free online.

Co-authors **Jo Handelsman, Ph.D.,** Howard Hughes Medical Institute Professor at the University of Wisconsin-Madison, Editor-in-Chief of DNA and Cell Biology, and President of the Rosalind Franklin Society, and **Robert Birgeneau, Ph.D.,** Chancellor of the University of California, Berkeley, contend that "a few significant changes in the academic system" in the U.S. could move more accomplished women scientists into positions of leadership, helping to balance the current gender inequality in the hierarchy of academia and to fortify the country's overall scientific leadership. The Rosalind Franklin Society, established in early 2007 by Mary Ann Liebert, honors the achievements of the woman who pioneered the discovery of the structure of DNA by working to encourage greater opportunities for women in the biomedical sciences through education, mentoring, and advocacy.

Building on the findings of a National Academy report entitled "Beyond Bias and Barriers," which attributes the lack of women in academic leadership positions to a combination of "unconscious biases" and "archaic university structures," Handelsman and Birgeneau support the Academy's recommendation for "educating the academic community about the insidious role of unconscious bias in decision-making."

Furthermore, they point to the antiquated tenure system, in which women are often held back from advancing to tenured professorships because of child-bearing and family responsibilities, as being in need of reform. Relatively simple and straightforward changes such as tenure clock extensions, quality childcare, or job-sharing could enable an existing pool of talented and capable women scientists to move into the upper echelons of academia and scientific research and boost America's competitiveness in research output across a variety of scientific and engineering disciplines.

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http://www.liebertpub.com/prdetails.aspx?pr_id=582

Bad to the bone: UD research to shed light on osteoporosis

Liyun Wang, UD assistant professor of mechanical engineering, views osteocytes (bone cells) in her lab, as graduate students Wen Li and Xiaozhou Zhou examine the magnified images in the background.
12:50 p.m., Nov. 15, 2007--Ten million people in the United States are estimated to already have bone diseases, and almost 34 million more are estimated to have low bone mass, putting them at increased risk for osteoporosis, according to the National Osteoporosis Foundation.

Liyun Wang, assistant professor of mechanical engineering at the University of Delaware, knows the serious consequences of osteoporosis.

Two of Wang's aunts have suffered from the insidious bone-thinning disease, and one aunt died within a year after falling and fracturing her hip.

Wang is now leading research that will shed light on how osteocytes--the cells encased inside your bones--sense external stimuli and communicate with cells on the surface, signaling them to either build more bone or remove existing bone.

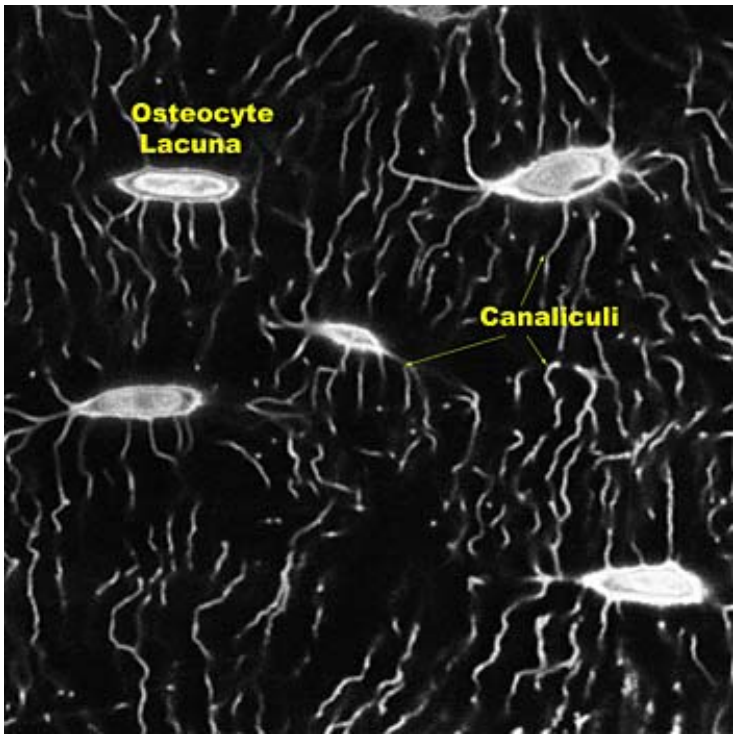
The five-year, $1.6 million project, ranked in the top 5 percent of research proposals recommended for funding by the National Institutes of Health (NIH) this year, holds promise in unveiling the mysteries of bone and joint diseases afflicting people worldwide.

The results may not only help scientists home in on the cause of osteoporosis and arthritis, but also develop more effective drug therapies to treat the debilitating bone and joint diseases.

The project will involve an interdisciplinary team of investigators at UD, including Prof. Mary C. Farach-Carson and Associate Prof. Randall Duncan, who hold primary appointments in biological sciences with joint appointments in mechanical engineering, and John Novotny, assistant professor of mechanical engineering.

“Bone and joint disorders affect almost half of all people over 50 years old, at a cost of $250 billion annually in the United States,” Wang said. “A third of the people who suffer a fracture due to bone loss end up dying within a year.”

The embedded bone cells, or osteocytes, that Wang is studying, act like the bone's “brain.”



Osteocytes lie in tiny holes or pits (lacunae) inside the bone. These embedded cells have many long arms that connect them to surface bone cells and the bone's vascular system. Tiny channels housing the osteocyte's arms (canaliculi) and the lacunae form a network through which water, nutrients, and other bioactive molecules flow. Courtesy of Liyun Wang.

"The osteocytes are very smart," Wang says. "They can tell whether a person is using his or her bones or not. If the person is physically active, the osteocytes tell cells on the surface that it's okay to put on more bone. Otherwise, they signal the surface cells to remove bone at a rate that can be as high as 3 percent bone mass per month, which is the case for patients confined to long-term bed rest and for astronauts," she notes.

The osteocytes lie in tiny pits or holes, called lacunae, within the bone. These living cells have many long arms that connect them to surface bone cells and the bone's vascular system. The narrow channels housing the osteocyte's arms (*canaliculi)* and the lacunae form a network through which a mixture of water, nutrients and other bioactive molecules flows.

"Although it is hard as cement, bone is actually like a stiff sponge," Wang says. "It's porous and has water inside. When we have mechanical loading, when you run, for example, a part of the leg bone is compressed, and water is pushed through gaps, less than a micrometer in size, between the osteocytes and the bone cement that surrounds them."

This powerful wave of fluid keeps the osteocytes happy and functioning well, Wang says, delivering nutrients to them from nearby blood vessels and quickly dispersing signaling molecules, such as calcium ions, from one cell to its neighbors.

Using a novel microscopic imaging method that Wang developed, which is based on fluorescence recovery after photobleaching (FRAP), the research team hopes to do what no one has done before: see inside living bone and determine how rapidly these signaling and nutrient molecules are transferred between the cells when a bone is at rest and when it is at work.

A high-powered laser-scanning microscope will be used to assess the movement of molecules in the tibia of an anesthetized mouse. A harmless green fluorescent dye, tagged to various-sized proteins, signaling molecules and cell nutrients, will be injected into the animal's bloodstream.

The dyed molecules will be subjected to a flash of intense light, temporarily photobleaching them black, leaving a distinct black sector surrounded by green. Thus, if the molecules diffuse into one another's territories, they can easily be tracked by color.

Using similar techniques, Wang is investigating the communication between bone and cartilage in the development and progression of osteoarthritis, one of five projects in an $11 million NIH grant led by

Thomas Buchanan, professor and chairperson of the UD Department of Mechanical Engineering. The UD effort includes a unique mentoring program for women scientists.

Wang says she is grateful for the mentoring and support she has received from her colleagues at UD since she joined the faculty in 2005, as well as from her doctoral advisers at the City College of New York, including Profs. Susannah Fritton, Steve Cowin, and Sheldon Weinbaum; and Dr. Mitchell Schaffler, with whom she worked as a postdoctoral researcher at the Mt. Sinai School of Medicine.

Currently, Wang's laboratory group includes Wen Li, a graduate student in biomechanics and movement science, Xiaozhou Zhou, a graduate student in mechanical engineering, and undergraduate students Ben Keller and Laura Schultz, who are both working on degrees in mechanical engineering, and Samantha Nigro, who is pursuing her degree in biological sciences. Research associate Jun Pan will join the group at the end of this year.

“My students have been excellent,” Wang says, smiling. “They are well-organized and eager to learn how to do research. They are very motivated, and that is important. We have exciting work ahead of us!”

Wang is seeking two additional doctoral students and one postdoctoral researcher in the areas of biomechanics, orthopedic biology or mechanical engineering to join her research team. For more information, contact Wang at [lywang@udel.edu].

Article by Tracey Bryant
Photo by Kathy F. Atkinson

http://www.udel.edu/PR/UDaily/2008/nov/osteoporosis111507.html

White children more positive toward blacks after learning about racism, study shows

AUSTIN, Texas—Challenging the idea that racism education could be harmful to students, a new study from The University of Texas at Austin found the results of learning about historical racism are primarily positive. The study appears in the November/December issue of the journal Child Development.

Psychologists Rebecca Bigler and Julie Milligan Hughes found white children who received history lessons about discrimination against famous African Americans had significantly more positive attitudes toward African Americans than those who received lessons with no mention of racism. African-American children who learned about racism did not differ in their racial attitudes from those who heard lessons that omitted the racism information, the study showed.

"There is considerable debate about when and how children should be taught about racism," says Bigler, director of the university's Gender and Racial Attitudes Lab. "But little research has examined elementary-school-aged children's cognitive and emotional reactions to such lessons."

To examine the consequences for white and African-American children of learning about historical racism, the researchers presented biographical lessons about 12 historical figures (six African Americans and six European Americans) to two groups of children ages 6-11.

For each group, some lessons provided information about racism, such as racially biased hiring practices and segregation, while others omitted this information. After the lessons, the children were interviewed about their racial attitudes and reactions, including guilt, defensiveness and anger.

Both white and black children who learned about racism were more likely to value racial fairness and to express greater satisfaction with the lesson. White children whose lessons included information on discrimination showed more defensiveness, had more racial guilt (if they were older than 7) and were less likely to accept stereotypical views about African Americans.

While the study shows learning about racism is beneficial to both black and white children, Bigler notes the lessons did not present information about the most violent forms of racial prejudice (for example, lynching).

"Additional work on the topic is needed so that we know how to best present to children some of the more abhorrent truths from U.S. history," Bigler says.

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The National Science Foundation funded the research.

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http://www.eurekalert.org/pub_releases/2007-11/uota-wcm111207.php

Environment plays key role in children's readiness for school

Early school success seems to depend largely on children entering school ready to learn, and many policy initiatives have highlighted the importance of preparing children for school entry. A new study finds that children's environment plays a major role in their readiness for school, suggesting that intervention could help boost readiness in at-risk youngsters.

The study, conducted by researchers at Laval University, the University of Montreal, and the University of Quebec at Montreal, appears in the November/December 2007 issue of the journal Child Development. It is one of the first studies to consider both environmental and genetic influences on children's readiness for school.

The researchers examined 420 pairs of 5-year-old twins, assessing the children on four measures of school readiness that included identifying colors and shapes; answering questions about spatial position (such as above, below, left, right), relative size (such as smaller, bigger), and order (such as first, middle, last); identifying numbers and counting; and identifying letters and writing. Two years later, the children's teachers were asked to rate the school achievement of 237 pairs of the twins.

Environmental factors shared by twins in the same family–such as family resources and income, parents' behavior with respect to learning, and the twins' child care experiences–were responsible for much of the individual difference in the children's school readiness skills, according to the study. The influence of the environmental factors was seen over and above the influence of genetic factors. These shared factors influenced school readiness in both general and specific ways, that is, they were found to be significant for each component of school readiness, as well for the core abilities underlying overall school readiness.

Genetic factors played a significant role in the children's core abilities underlying the four components of school readiness, but the environment shared by twins of the same family remained the most important factor overall. Both genetic and environmental factors were found to influence the association between children's school readiness and later school achievement.

"Our results have important implications for preventive interventions," said Michel Boivin, Canada Research Chair in Child Social Development and professor of psychology at Laval University in Quebec City and one of the study's authors. "They should be seen as a further incentive for continued implementation and evaluation of preventive intervention programs aimed at improving the level of school readiness in children from at-risk families."

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Summarized from Child Development, Vol. 78, Issue 6, The Genetic-Environmental Etiology of Cognitive School Readiness and Later Academic Achievement in Early Childhood by Lemelin, J-P, Boivin, M, Forget-Dubois, N, and Dionne, G (Laval University), Séguin, JR (University of Montreal), Brendgen, M (University of Quebec at Montreal), Vitaro, F, Tremblay, RE, and Pérusse, D (University of Montreal).

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http://www.eurekalert.org/pub_releases/2007-11/sfri-epk110707.php

MIT develops lecture search engine to aid students

Anne Trafton, News Office
November 7, 2007

Imagine you are taking an introductory biology course. You're studying for an exam and realize it would be helpful to revisit the professor's explanation of RNA interference. Fortunately for you, a digital recording of the lecture is online, but the 10-minute explanation you want is buried in a 90-minute lecture you don't have time to watch.

A new lecture search engine developed at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) could help with this dilemma. Created by a team of researchers and students led by MIT associate professor Regina Barzilay and principal research scientist James Glass, the web-based technology allows users to search hundreds of MIT lectures for key topics.

"Our goal is to develop a speech and language technology that will help educators provide structure to these video recordings, so it's easier for students to access the material," said Glass, who is head of CSAIL's Spoken Language Systems Group.

More than 200 MIT lectures are currently available on the site (web.sls.csail.mit.edu/lectures/). So far, most of the users are international students who access the lectures through MIT's OpenCourseWare (OCW) initiative, which makes curriculum materials for most MIT courses available to anyone with Internet access. Although the lecture-browsing system is still in the early development stages, a recent announcement in OCW's newsletter has drawn increased traffic to the site.

Barzilay and Glass expect the system will be most useful for OCW users and for MIT students who want to review lecture material. MIT World, a web site that provides video of significant MIT events such as lectures by speakers from MIT and around the world, is also participating in the project.

Many MIT professors record their lectures and post them online, but it's difficult to search them for specific topics. Because there is no way to easily scan audio, as you can with printed text, "you end up watching the whole thing, and it's hard to keep focused," said Barzilay, the Douglas T. Ross Career Development Associate Professor of Software Development in the Department of Electrical Engineering and Computer Science.

On the prototype web site, users can search lectures for any term they want and then play the relevant sections.

The lecture transcripts are created by speech recognition software. One major challenge is that the lectures usually contain many technical terms that might not be in the computer program's vocabulary, so the researchers use textbooks, lecture notes and abstracts to identify key terms and feed them into the computer.

"These lectures can have a very specialized vocabulary," said Glass. "For example, in an algebra class, the professor might talk about Eigenvalues."

When properly adapted to a speaker and topic, the lecture-based speech recognizer gets about four out of five words correct, however most of the errors occur in words that are not critical to the lecture topic, i.e., not the key vocabulary terms that people would use to search.

Once the transcript is complete, a language processing program divides the text into sections by topic. Chunks of text, about 100 words each, are compared with each other using a mathematical formula that calculates the number of overlapping words between the text blocks. Each word is weighted so that repetition of key terms has more weight than less important words, and chunks with the most similar words are grouped into sections.

In the future, Barzilay and Glass hope to add a lecture summarization feature to the language processing system. They also want to get users more involved in the project, by incorporating a Wikipedia-like function that would let users correct errors in lecture transcripts and allow them to add lecture notes.

The researchers presented their project at the Interspeech 2007 conference in Antwerp, Belgium, in August. The project was originally funded by Microsoft through the iCampus program and is now funded by the National Science Foundation.

A version of this article appeared in MIT Tech Talk on November 7, 2007

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http://web.mit.edu/newsoffice/2007/lectures-tt1107.html

A dose of God may help medicine

Waltham, MA—For some families, the cancer diagnosis of a child strengthens existing religious ties or prompts new ones. Now, a new study by researchers at Brandeis University and the University at Buffalo - SUNY in Pediatric Hematology and Oncology reports that while most pediatric oncologists say they are spiritual, and many are open to connecting with the families of very sick children through religion or spirituality, they typically lack the formal healthcare training that could help them build such bridges.

"Increasingly, religion and spirituality are being recognized as important in the care of critically ill patients and we know that many parents draw on such resources to cope with their child's illness," said coauthor Wendy Cadge, a Brandeis sociologist. "This study suggests that we should consider training to help physicians relate spiritually to families confronting life-threatening illness such as cancer."

The study surveyed 74 pediatric hematologists and oncologists at 13 elite hospitals from the U.S. News & World Report ranking of "honor roll hospitals." The findings include:

- 93.3 percent of the physicians surveyed were raised in a religious tradition; 31 percent Protestant; 25.7 percent Catholic; 25.7 Jewish, and 10.8 percent other.
- The majority reported that religion was very important (25.7 percent) or somewhat important (48.6 percent) in their family when they were growing up.
- 24.3 percent of the physicians said they were Jewish; 20.3 percent said they had no current religious affiliation; 17 percent were Catholic; 17 percent were Protestant; almost 15 percent identified with another religion.
- 47.3 percent described themselves as very or moderately spiritual; 37.8 percent described themselves as slightly spiritual; 13.5 percent described themselves as not at all spiritual.

More than half of the respondents said their spiritual or religious beliefs influence to some extent their interactions with families, patients, and colleagues, while almost 40 percent believed they did not.

"Research shows that many patients do not feel the medical system adequately meets their spiritual needs," said Cadge. "By shedding light on how religion and spirituality connect to the practice of medicine, this study is a first step toward addressing such needs of patients and their families during a profoundly threatening chapter of life."

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MU Economic Researchers Find That Experienced Teachers Reap the Benefits of Pension Spikes, Then Retire

Nov. 14, 2007

Story Contact: Bryan C. Daniels, (573) 882-9144, DanielsBC@missouri.edu

COLUMBIA, Mo. – Teacher shortages and requirements associated with the No Child Left Behind Act combine to make experienced teachers valuable assets. However, despite their high demand, an increasing number of seasoned educators are retiring. Economic researchers have found the structure of many teacher pension plans is the primary reason that many elect to retire.

Likewise, the researchers said those plans have the effect of locking younger teachers, who may want to leave or are better suited for another job, into "putting in time" so as to receive a large spike in pension wealth.

In their study, Robert M. Costrell, professor of education reform and economics at the University of Arkansas, and Michael Podgursky, professor of economics at the University of Missouri-Columbia, found that teacher pensions don't have a smooth, uniform trajectory of wealth accumulation. Rather, the plans are typified by sharp peaks and valleys caused by changes in the annual annuity payment (determined by a benefit formula) and the number of years a teacher can expect to collect it.

Costrell and Podgursky said that arrangement entices teachers to stay on the job until they reap the benefits of sharp pension spikes and then pushes them to retire early – often in their early to mid-50s. The researchers said that for those who want to leave the profession, working just a few more years can mean a difference of several hundred thousand dollars.

Not surprisingly, they said, many teacher pension systems are allowing educators to continue to teach and collect their pensions at the same time, which is referred to as "double-dipping." Those provisions, such as part-time employment, employment in areas with shortages and returning to full-time duty after a specified break in service, seem to be expanding, they said.

In Arkansas, one of the five states in their study, Costrell and Podgursky noticed that for a teacher who entered the profession at age 25, a particularly sharp spike occurs at age 50 – when that teacher's pension wealth increases by almost five times his or her salary. Pension wealth accrual drops off precipitously the following year and by age 54 has turned negative. Similarly, teachers in Missouri, California, and Massachusetts experience pension spikes in their early to mid-50s, followed by much slower growth and ultimately shrinking pension wealth.

They said state legislatures often enhance the benefit formula when the stock market is up and the value of pension funds is high. Then, when the market falls, state officials find themselves saddled with large, unfunded liabilities. Costrell and Podgursky point to benefit enhancements enacted by the legislatures in California and Massachusetts that have created spikes where none previously existed. In Arkansas, benefit enhancements over the years have shifted the spike to benefit those who retire early, they said. Likewise, Ohio's multi-spiked system reflects its history of legislative benefit enhancements: the state once had a single pension spike for teachers at age 60; it now has three spikes, beginning at age 50.

The study, "Peaks, Cliffs, and Valleys: The Peculiar Incentives of Teacher Pensions," will be published in the winter 2008 edition of Education Next.

http://munews.missouri.edu/news-releases/2007/1114-podgursky.php

Early academic skills, not behavior, best predict school success

An educational study unprecedented in scope finds that children who enter kindergarten with elementary mathematics and reading skills are the most likely to experience later academic success -- whether or not they have social or emotional problems.“We find the single most important factor in predicting later academic achievement is that children begin school with a mastery of early math and literacy concepts,” said Northwestern University researcher Greg Duncan and the study's primary author. Attention-related skills, though more modestly, also consistently predict achievement.

But it is the seeming lack of association between social and emotional behaviors and later academic learning that most surprised the researchers -- a lack of association as true for boys as for girls and as true for children from affluent families as for those from less affluent families.“Children who engage in aggressive or disruptive behavior or who have difficulty making friends wind up learning just as much as their better behaved or more socially adjusted classmates provided that they come to school with academic skills,” said Northwestern's Duncan. “We do not know if their behavior affects the achievement of other children.”

Appearing in the November issue of Developmental Psychology, the study findings are based on an analysis of existing data from more than 35,000 preschoolers in the United States, Canada and England.“The paramount importance of early math skills -- of beginning school with a knowledge of numbers, number order and other rudimentary math concepts -- is one of the puzzles coming out of the study,” said Duncan, Northwestern’s Tarry Professor of Education and Social Policy and a Faculty Fellow at the Institute for Policy Research.Controlling for IQ, family income, gender, temperament, type of previous educational experience, and whether children came from single or two parent families, the study found that the mastery of early math concepts on school entry was the very strongest predictor of future academic success.

“Mastery of early math skills predicts not only future math achievement, it also predicts future reading achievement,” Duncan said. “And it does so just as reliably as early literacy mastery of vocabulary, letters and phonetics predicts later reading success.” The opposite -- reading skills predicting math success -- does not hold up.The study’s conclusions about the importance of early academic and attention skills are consistent with recommendations from expert panels of early mathematics and literacy professionals. The study’s authors did not look at curricula.

“Certainly we’re not suggesting that preschool programs abandon play and impose dull ‘drill-and-practice’ curricula,” Duncan said. “Play-based curricula designed with the developmental needs of children in mind can foster the development of academic and attention skills in ways that are engaging and fun.”Using six longitudinal studies, the authors of “School Readiness and Later Achievement” measured school readiness skills and behaviors when a child entered school (at around age 5) and measured for later academic achievement between ages 7 and 14.

Support for the study came from the Center for the Analyses of Pathways from Children to Adulthood at the University of Michigan, a National Science Foundations-funded Developmental Science Center.

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Children's peer victimization -- a mix of loyalty and preference

New research into childhood prejudice suggests that loyalty and disloyalty play a more important role than previously thought in how children treat members of their own and other groups. Funded by the Economic and Social Research Council (ESRC), a study into the 'black sheep effect', shows that children treat disloyalty in their own group more harshly than disloyalty within different groups.

Professor Dominic Abrams, of Kent University, who led the research team, says the findings will be valuable when applied to the classroom.

"This research has implications for peer victimisation and bullying as well as for the understanding and management of prejudice and discrimination in schools".

For the past 30 years, research into prejudice between different groups suggested that children progress from regarding groups of people in simple terms of difference, such as White or Black, to regarding people more as unique individuals. However, this does not easily explain why prejudice happens at different ages for different types of groups or why adults continue to show prejudice.

The new research was stimulated by evidence that adults may show strong bias in favour of or against groups while also being staunch critics of individual members within those same groups. Rather than becoming less prejudiced with age, young people can grow to support their own group in a more targeted and sophisticated way. They focus not just on whether peers belong to their own group, but on how well they conform to social values, such as loyalty to the group.

Carried out with more than 800 children aged between 5-12 years, a series of 7 experimental studies showed that children in this early age group favoured loyal peers more if these peers belonged to the same group as themselves than if they belonged to a different group. Disloyalty within outside groups was seen to be more valued and not criticized in the same way as it would be from members of their own group. This "black-sheep effect" was found within national groups (French and English) and within gender groups where it was clearer for boys than girls.

The research consistently supported a new model, known as the Development Model of Subjective Group Dynamics, challenging previous theories of childhood prejudice. According to Professor Abrams, a more complete developmental account of 'intergroup' prejudice must understand not just why particular groups are victimized but also how children decide which individuals within those groups should be singled out for specially positive or specially negative treatment.

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NOTES FOR EDITORS

1. The research "Children's Evaluations of Deviant Ingroup and Outgroup Members', was funded by the Economic and Social Research Council. It was carried out by Professor Dominic Abrams and Professor Adam Rutland of the University of Kent

2. Methodology -.A series of 7 experimental studies were carried out on groups involving more than 800 children aged between 5 and 12 years. They were asked about their perceptions and evaluations of other 'target' children described as belonging either to an 'ingroup' (school, team, nationality, gender) or a contrasting or competing group. Some targets were described as conforming to their group norms by displaying loyalty (normative targets), other (deviant) targets behaved in ways more consistent with the norms of the outgroup.

3. The Economic and Social Research Council (ESRC) is the UK's largest funding agency for research and postgraduate training relating to social and economic issues. It supports independent, high quality research relevant to business, the public sector and voluntary organisations. The ESRC's planned total expenditure in 2007 - 08 is £181 million. At any one time the ESRC supports over 4,000 researchers and postgraduate students in academic institutions and research policy institutes. More at http://www.esrcsocietytoday.ac.uk

4. 4. ESRC Society Today offers free access to a broad range of social science research and presents it in a way that makes it easy to navigate and saves users valuable time. As well as bringing together all ESRC-funded research and key online resources such as the Social Science Information Gateway and the UK Data Archive, non-ESRC resources are included, for example the Office for National Statistics. The portal provides access to early findings and research summaries, as well as full texts and original datasets through integrated search facilities. More at http://www.esrcsocietytoday.ac.uk

5. The ESRC confirms the quality of its funded research by evaluating research projects through a process of peer review.

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http://www.eurekalert.org/pub_releases/2007-11/esr-cpv110607.php

Why you remember names and ski slopes

Researchers discover personal trainer for your memory

CHICAGO --- When you meet your boss's husband, Harvey, at the office holiday party, then bump into him an hour later over the onion dip, will you remember his name?

Yes, thanks to a nifty protein in your brain called kalirin-7.

Researchers at Northwestern University's Feinberg School of Medicine have discovered the brain protein kalirin is critical for helping you learn and remember what you learned.

Previous studies by other researchers found that kalirin levels are reduced in brains of people with diseases like Alzheimer's and schizophrenia. Thus, the discovery of kalirin's role in learning offers new insight into the pathophysiology of these disorders.

"Identifying the key role of this protein in learning and memory makes it a new target for future drug therapy to treat or delay the progression of these diseases," said Peter Penzes, lead author of the study and assistant professor of physiology at the Feinberg School. Penzes studied the brains of laboratory rats which are similar to human brains.

The study will be published November 21 in the journal Neuron.

Kalirin behaves like a personal trainer for your memory. When you learn something new, kalirin bulks up the synaptic spines in your brain -- which resemble tiny, white mushrooms. The spines grow bigger and stronger the more you repeat the lesson. It works the same whether you're learning a new cell phone number, skiing a new double black diamond slope or testing a pumpkin cheesecake recipe.

Synaptic spines are the sites in the brain where neurons (brain cells) talk to each other. "If these sites are bigger, the communication is better," Penzes said. "A synapse is like a volume dial between two cells. If you turn up the volume, communication is better. Kalirin makes the synaptic spines grow."

Kalirin's role in learning and memory help explain why continued intellectual activity and learning delays cognitive decline as people grow older. "It's important to keep learning so your synapses stay healthy," Penzes said.

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Curbing world's most fatal diseases: consensus created by health experts offers global prescription

20 'grand challenges' in chronic non-communicable diseases, 1st agreed roadmap to reduce rising toll of slow killer illnesses

Several of the world's most eminent health scientists and organizations today publish a landmark global consensus on the 20 foremost measures needed to curb humanity's most fatal diseases, their study featured in Nature magazine.

Known as chronic, non-communicable diseases, they are reaching world epidemic proportions and include cardiovascular diseases (mainly heart disease and stroke), several cancers, chronic respiratory conditions, and type 2 diabetes.

In their paper for Nature, the 19 authors (list appended) say chronic non-communicable diseases:

- Cause the greatest share of death and disability worldwide;
- Account for over 60% of deaths worldwide, four-fifths of those fatalities being citizens of low and middle income countries;
- Cause twice as many deaths as the combined total of HIV/AIDS, tuberculosis, malaria, maternal and peri-natal conditions, and nutritional deficiencies.

Lead author Dr. Abdallah S. Daar, senior scientist and co-director, program on life sciences, ethics and policy, McLaughlin-Rotman Centre for Global Health; professor of public health sciences and of surgery,...
Click here for more information.

Researchers used the structured consensus-building "Delphi" technique to create the "Grand Challenges in Chronic Non-Communicable Diseases (CNCDs)" – a distillation of informed opinions drawn from 155 panel members across 50 nations, carefully selected from recommendations.

Study authors say the result is an authoritative list of the 20 most important challenges today to restraining and reversing the toll of these slow killer illnesses. The list of Grand Challenges is accompanied by research priorities for meeting them, drawn from the study data and finalized by 27 leading world health figures guiding the project (list appended).

CNCDs, defined by the WHO as cardio-vascular disease, type 2 diabetes, chronic respiratory diseases and certain cancers, are largely preventable. It's estimated that eliminating key risk factors (poor diet, physical inactivity, smoking) would prevent 80% of heart disease, strokes and type 2 diabetes, and over 40% of cancer cases.

The initiative's leaders say their goals are "to galvanize the health, science and public policy communities into action on this epidemic," and to foster global debate, support and funding.

Leading partners behind the project are the McLaughlin-Rotman Center (MRC) for Global Health (University Health Network and University of Toronto), Toronto; the Oxford Health Alliance (OxHA), London; the UK Medical Research Council (UK MRC), London; the Canadian Institutes of Health Research (CIHR), Ottawa; and the US National Institutes of Health (NIH), Bethesda.

The 20 Grand Challenges (appended) are of equal precedence – there is no priority assigned within the list, says lead author Dr. Abdallah S. Daar of the McLaughlin- Rotman Center.

The Grand Challenges are grouped under six broad goals:

- Reorient health systems (e.g. Grand Challenge: "Allocate resources within health systems based on burden of disease");
- Mitigate health impacts of poverty and urbanization (e.g.: "Study and assess how poverty increases risk factors");
- Engage businesses and community (e.g.: "Make business a key partner in promoting health and preventing disease; Develop and monitor codes of responsible conduct with the food, beverage and restaurant industries");
- Modify risk factors (e.g.: "Deploy universally measures proven to reduce tobacco use and boost resources to implement the WHO framework Convention on Tobacco Control");
- Enhance economic, legal and environmental policies (e.g. "Study and address the impacts of poor health on economic output and productivity"); and
- Raise public and political awareness (e.g.: "Promote healthy lifestyle and consumption choices through effective education and public engagement").

The Grand Challenges in CNCDs complement the "Grand Challenges in Human Health," published in 2003 by the Bill and Melinda Gates Foundation and partners, an initiative focused mainly on infectious disease, especially in developing countries.

"Without concerted action, some 388 million people will die of one or more CNCDs in the next 10 years," according to co-author Nizal Sarrafzadegan, Professor, Isfahan University of Medical Sciences, Iran. "With concerted action, the number of premature deaths prevented by 2015 would total at least 36 million – a number of people roughly equal to the population of Canada, Algeria or Kenya."

Noting the economic impact of CNCDs, co-author Robert Beaglehole, former WHO Director (Department of Chronic Diseases and Health Promotion), says that unless serious action is taken now, over the next decade China, India and the U.K. will lose an estimated $558 billion, $237 billion and $33 billion respectively in foregone national income due to heart disease, stroke and diabetes.

"While these challenges are applicable to all countries, different nations should identify local priorities from among those identified here for immediate attention, depending on resources and disease patterns," says John Bell, Regius Professor of Medicine, University of Oxford and Chair, Oxford Health Alliance.

Process

Identifying the Grand Challenges involved the Delphi method — the structured, sequential, written questioning of a panel. The first round elicited 1,854 ideas, distilled into 109 from which the panel members selected and commented on their top 30. In the final round, panelists either accepted the list or reordered choices, and offered further comment.

The seven-member Executive Committee and 19-member Scientific Board milled the wording of the panel's final 20 Grand Challenges, grouped them according to six goals, and suggested the key research requirements for reaching each goal.

Next steps

The Grand Challenges Global Partnership is being established with a secretariat at the Oxford Health Alliance (www.oxha.org), funded for the first five years by OxHA members.

The founding partners:

- Oxford Health Alliance, UK;
- Medical Research Council, UK;

- Canadian Institutes of Health Research, Canada;
- Indian Council of Medical Research, India;
- The National Institutes of Health, USA;
- Ovations Chronic Disease Initiative, UK.

The Partnership is intended as a platform for collaboration of global research funding organizations. An advocacy program to be developed will encourage adoption of the Challenges and Goals.

“Without a roadmap, we are all driving in different directions. These problems require long-term commitment and a coordinated effort between multiple funding agencies around a set of clear priorities,” says co-author Peter A. Singer, Interim Director, McLaughlin-Rotman Centre for Global Health, Toronto, Canada.

Says Nirmal Ganguly, Director General, Indian Council of Medical Research: “Providing priorities will be the major contribution from this Grand Challenges exercise. The growing interest in this area of research now being registered by governments and funding agencies alike suggests that substantial resources may be available in the future to pursue these priorities.”

“Chronic non-communicable diseases constitute the major burdens of illness and disability in all countries of the world apart from sub-Saharan Africa,” says Stig Pramming, Executive Director, Oxford Health Alliance. “They must urgently receive more resources, research and attention, in proportion to the burden of disease as mapped out in these Grand Challenges. Inaction is costing millions of premature deaths throughout the world and will offset the gains from a decreasing burden of infectious diseases.”

"This study has the potential to galvanise more effective action against chronic diseases,” concludes Dr. Daar. “In developing countries, many beset by infectious diseases, authorities have not resourced or thought through the policy implications of addressing these silent killers. But that's like putting out one fire in a house burning from both ends."

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Appendix

20 Grand Challenges in Chronic Non-Communicable Diseases

Goal: Raise public and political awareness

Grand Challenges

- Raise the political priority of non-communicable disease;
- Promote healthy lifestyle and consumption choices through effective education and public engagement;
- Package compelling and valid information to foster widespread, sustained and accurate media coverage and thereby improve awareness of economic, social and public health impacts.

Research Needed to Address Goals

- Study how to engage governments in partnerships for disease prevention;
- Develop research activities for health that bridge government departments (e.g. transport, civic planning, health, education and environment);
- Identify the reasons for low awareness and advocacy of chronic disease in societies;
- Study how to create public forums that sustainably raise awareness of CNCD issues.

Goal: Enhance economic, legal and environmental policies

Grand Challenges

- Study and address the impact of government spending and taxation on health;
- Develop and implement local, national and international policies and trade agreements, including regulatory restraints, to discourage the consumption of alcohol, tobacco and unhealthy foods;
- Study and address the impacts of poor health on economic output and productivity.

Research Needed to Address Goals

- Evaluate the health impacts of agricultural policy interventions;
- Study the health and economic impacts of comprehensive community-based interventions;
- Create general population metrics and outcome indicators for policy and program surveillance;
- Quantify impact of CNCDs on domestic economies;
- Study the international ramifications of change of food and tobacco consumption;
- Probe motivations behind domestic expenditures, and how these affect lifestyle choices;
- Investigate the impact and effectiveness of food labeling legislation.

Goal: Modify risk factors

Grand Challenges

- Deploy universally measures proven to reduce tobacco use and boost resources to implement the WHO Framework Convention on Tobacco Control;
- Increase the availability and consumption of healthy food;
- Promote lifelong physical activity;
- Better understand environmental and cultural factors that change behaviour.

Research Needed to Address Goals

- Do prospective cohort studies to identify risk factors, the magnitude of their effects, and factors that reduce risk of CNCDs;
- Evaluate foetal and early life influences on chronic disease risk;
- Find and evaluate new or combined medical preparations to prevent cardiovascular disease and diabetes, or reduce their morbidities;
- Evaluate behavioural modifications to reduce risks;
- Establish metrics, and relationships between metrics, which are culturally and ethnically specific;
- Investigate cultural and ethnic variation in risk factors to refine behavioural interventions;
- Quantify personal risk related to phenotypes, genotypes and multiplicative risks;
- Study the interaction of environment and genes in risk factors and in outcomes;
- Develop new biomarkers and diagnostics for risk and for early disease detection.

Goal: Engage businesses and community

Grand Challenges

- Make business a key partner in promoting health and preventing disease;
- Develop and monitor codes of responsible conduct with the food, beverage and restaurant industries;
- Empower community resources such as voluntary and faith-based organizations.

Research Needed to Address Goals

- Study marketing techniques and marketing data derived from commercial companies regarding behaviour modification;
- Investigate mechanisms for consumers and the public to influence food industry positively;
- Research the impact of taste, flavour, packaging, labeling and advertising on choice and health;
- Create and evaluate community-based strategies to promote healthy living;
- Identify modes of effective public/private partnerships that support health;
- Develop better understanding of nutrient benefit in foods.

Goal: Mitigate health impacts of poverty and urbanization

Grand Challenges

- Study and address how poverty increases risk factors;
- Study and address the links between the built environment, urbanization and chronic non-communicable disease.

Research Needed to Address Goals

- Investigate the biological basis of health risks related to poverty;
- Examine the influence of poverty on the adoption of high risk behaviour;
- Identify negative effects of economic growth on health;
- Study how to work with planners, architects and city representatives to enhance the environment for healthier living.

Goal: Reorient health systems

Grand Challenges

- Allocate resources within health systems based on burden of disease;
- Move health professional training and practice towards prevention;
- Increase number and skills of professionals who prevent, treat and manage chronic non-communicable diseases, especially in developing countries;
- Build health systems that integrate screening and prevention within health delivery

Research Needed to Address Goals

- Develop strategies to integrate health system management of communicable and non-communicable disease;
- Form collaborations to find best practices in delivering affordable and equitable health care;
- Study how to provide more structured knowledge for health-promotion;
- Develop strategies to ensure that medical training and curricula focus on chronic non-communicable diseases;
- Develop and provide culturally specific and nationally appropriate resources for training of health-care workers;
- Study how best to ensure that disadvantaged communities have adequate resource allocations in health care and in preventative practice;
- Optimise use of electronic health records for predicting disease and measuring the effect of health interventions;
- Study how best to develop and establish real time surveillance tools;
- Discover and develop tools for screening and stratifying populations according to risk;
- Increase access to medications to prevent complications of chronic non-communicable disease.

Grand Challenges in Non-Communicable Diseases

Executive Committee

(* Denotes Nature article co-author)

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The McLaughlin-Rotman Centre for Global Health, Program on Life Sciences, Ethics and Policy, Toronto, harnesses and fosters innovative technology for global health equity, optimizing its benefits and minimizing social risks. Based at the University Health Network / McLaughlin Centre for Molecular Medicine at the University of Toronto, the program was created in 2001 and led by Professors Abdallah Daar and Peter A. Singer.

For more information: www.mrcglobal.org

The Oxford Health Alliance (OxHA), London , is a public-private partnership committed to finding innovative solutions to the world's largest preventable health problem - the global epidemic of chronic diseases - by addressing the risk factors of unhealthy diet, physical inactivity and tobacco use. Particularly, OxHA brings together a cross-section of society to determine the role employers, governments, NGOs, businesses, urban planners, economists and young people can play in helping to make the healthy choices the easy choices. For more information: www.oxha.org

The Medical Research Council, London, is a publicly-funded organisation dedicated to improving human health. We support research across the entire spectrum of medical sciences, in universities and hospitals, in our own units and institutes in the UK, and in our units in Africa. The heart of our mission is to improve human health through world-class medical research.

For more information: www.mrc.ac.uk

The Canadian Institutes of Health Research, Ottawa, is the Government of Canada's health research funding agency supporting the work of more than 11,000 researchers and trainees in universities, teaching hospitals, and research institutes nationwide. CIHR funds research that improves health, the health care system and quality of life and fosters commercialization, moving discoveries from academic setting to the marketplace.

For more information: www.cihr-irsc.gc.ca

Case studies of community-based CNCD prevention interventions and corporate responses to CNCDs are available on request.

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http://www.eurekalert.org/pub_releases/2007-11/pols-cwm111807.php

Molecular 'foreman' discovered for brain wiring

Researchers have identified a master regulatory molecule that is responsible for triggering the remodeling of neuronal connections that is critical for learning. Malfunctioning of the connection-remodeling machinery that they identified may also play a role in mental retardation, schizophrenia, and drug addiction. Thus, said the researchers, knowledge of the machinery could lead to insights into those disorders.

Peter Penzes and colleagues published their findings in the November 21, 2007, issue of the journal Neuron, published by Cell Press.

In their experiments, the researchers sought to understand the biological machinery controlling the enlargement of mushroom-like structures called dendritic spines on neurons. Such spines are the receiving stations for neurotransmitters—signaling chemicals that one neuron launches to trigger a nerve impulse in its neighbor. During learning, these spines strengthen signaling between neurons during the process of laying down memory pathways in the brain.

Spine structure can also be involved in neurological disorders. Researchers have found abnormal dendritic spines in certain types of mental retardation, including autism spectrum disorders, as well as schizophrenia and drug addiction.

Specifically, Penzes and colleagues sought to discover whether a molecule called kalirin-7 plays a role in spine enlargement in mature neurons when they undergo a learning-related strengthening called long-term potentiation (LTP).

The researchers theorized that kalirin-7 might be a key regulator of spine development because it is found in high concentration in the spines of mature neurons. Also, kalirin-7 was known to play a role in the remodeling of the structural beams and studs of the cell, called the cytoskeleton.

The researchers' experiments with cultured neurons revealed that activation of neurons during LTP does indeed trigger kalirin-7 to turn on the machinery for remodeling spines, causing spines to become enlarged.

What's more, the researchers found that kalirin-7 also regulates the other major process necessary for strengthening neuronal signaling connections. Kalirin-7 controls the number of neurotransmitter-receiving stations, called receptors, that festoon the surface of dendritic spines. The number of these receptors determines the strength of signaling connections between neurons.

The researchers concluded that their findings "strongly suggest that kalirin-7 may be an important regulator of the experience-dependent modifications of forebrain circuits during postnatal development and may play an important role in learning and memory."

They also pointed out that altered spine structures "have been associated with mental retardation, neuropsychiatric disorders, and drug addiction. Specifically, aberrant spine morphology in forebrain occurs in many types of mental retardation, including fragile-X and autism spectrum disorders." Similarly, they noted, studies of schizophrenics have also revealed such alteration of dendritic spines, as well as evidence of defects in the kalirin-7 pathway.

"Therefore, our results may suggest potential strategies for treatments of these neurodevelopmental and psychiatric diseases," they wrote.

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The researchers include Zhong Xie, Deepak P. Srivastava, Huzefa Photowala, Li Kai, Michael E. Cahill, Kevin M. Woolfrey, Cassandra Y. Shum, D. James Surmeier, and Peter Penzes, of the Department of Physiology, Northwestern University Feinberg School of Medicine, Chicago, IL, USA.

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Top researcher argues most physicians aren't prepared to deal with obesity epidemic

The soaring obesity rates across the globe have been called the most critical challenge to public health of the 21st century. A top university researcher argues that most physicians are not adequately prepared to deal with this obesity epidemic.

In an article published in Canadian Family Physician, University of Alberta researcher Tim Caulfield examines the vital role physicians play in managing and identifying obesity and highlights the obstacles these physicians must overcome when treating obese patients. Caulfield, who is the Canada Research Chair in Health Law at the U of A and professor and research director in public health sciences, is recognized as one of the foremost experts in health law research in Canada.

In North America, physicians have a legal obligation to provide their patients with a reasonable standard of care, says Caulfield. By law, overweight and obese patients are entitled to the same level of care as the general public; however, there are reasons to believe this patient population is not, in some circumstances, receiving optimal care and advice.

Available data indicates that many physicians do not have the skills and knowledge to address obesity. According to Caulfield, this could contribute to substandard care in the way obesity is handled and in the way obese patients are treated.

"Family physicians play a crucial role in identifying and managing obesity," says Caulfield. "As the rates of obesity become more prevalent, we need to recognize and become aware of the issues that can reduce liability and improve the care of these patients."

Caulfield notes that earlier studies have found that most physicians (83 per cent) were less likely to perform physical examinations on reluctant obese patients, and 17 per cent admitted reluctance to perform pelvic exams on obese patients. One study found that one-fourth of physicians think that they are not at all or only slightly competent recommending treatment for obese patients.

As obesity rises, Caulfield notes, so will the number of malpractice suits. "By identifying the legal issues that may come with treating these patients, it will become easier for family physicians to address weight management."

Steps should be taken, according to Caulfield, to ensure family physicians have the skills, tools and resources necessary to satisfy their legal duties and to optimize their role in managing this complex public health concern.

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