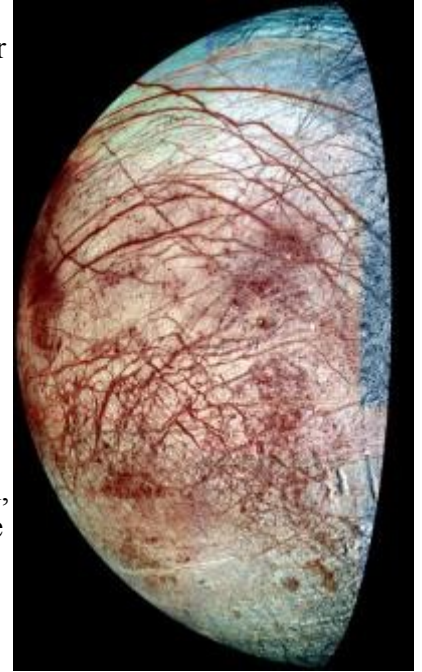


## Europa's hidden ice chemistry

The frigid ice of Jupiter's moon Europa may be hiding more than a presumed ocean: it is likely the scene of some unexpectedly fast chemistry between water and sulfur dioxide at extremely cold temperatures. Although these molecules react easily as liquids - they are well-known ingredients of acid rain - Mark Loeffler and Reggie Hudson at NASA's Goddard Space Flight Center in Greenbelt, Md., now report that they react as ices with surprising speed and high yield at temperatures hundreds of degrees below freezing. Because the reaction occurs without the aid of radiation, it could take place throughout Europa's thick coating of ice - an outcome that would revamp current thinking about the chemistry and geology of this moon and perhaps others.

"When people talk about chemistry on Europa, they typically talk about reactions that are driven by radiation," says Goddard scientist Mark Loeffler, the first author on the paper being published Oct. 2 in *Geophysical Research Letters*. That's because the moon's temperature hovers around 86 to 130 Kelvin, or about -200° to -143°C. In this extreme cold, most chemical reactions require an infusion of energy from radiation or light. On Europa, the energy comes from particles from Jupiter's radiation belts. Because most of those particles penetrate just fractions of an inch into the surface, models of Europa's chemistry typically stop there.



*The icy surface of Europa is shown strewn with cracks, ridges and "chaotic terrain," where the surface has been disrupted and ice blocks have moved around. New laboratory experiments show that water ice and frozen sulfur dioxide react even at the frigid temperatures of Europa. Because the reaction occurs without the aid of radiation, it could take place throughout the moon's thick ice layer -- an outcome that would revamp current thinking about the chemistry and geology of this moon and perhaps others. JPL/University of Arizona*

"Once you get below Europa's surface, it's cold and solid, and you normally don't expect things to happen very fast under those conditions," explains co-author Reggie Hudson, the Associate Lab Chief of Goddard's Astrochemistry Laboratory.

"But with the chemistry we describe," adds Loeffler, "you could have ice 10 or 100 meters [roughly 33 or 330 feet] thick, and if it has sulfur dioxide mixed in, you're going to have a reaction."

"This is an extremely important result for understanding the chemistry and geology of Europa's icy crust," says Robert E. Johnson, who is an expert on radiation-induced chemistry on planets and is the John Lloyd Newcomb Professor of Engineering Physics at the University of Virginia in Charlottesville.

From remote observations, astronomers know that sulfur is present in Europa's ice. Sulfur originates in the volcanoes of Jupiter's moon Io, then becomes ionized and is transported to Europa, where it gets embedded in the ice. Additional sulfur might come from the ocean that's thought to lie beneath Europa's surface. "However," says Johnson, "the fate of the implanted or any subsurface sulfur is not understood and depends on the geology and chemistry in the ice crusts."

In experiments that simulated the conditions on Europa, Loeffler and Hudson sprayed water vapor and sulfur dioxide gas onto quarter-sized mirrors in a high-vacuum chamber. Because the mirrors were kept at about 50 to 100 Kelvin (about -223° to -173°C), the gases immediately condensed as ice. As the reaction proceeded, the researchers used infrared spectroscopy to watch the decrease in the concentrations of water and sulfur dioxide and the increase in the concentrations of positive and negative ions generated.

Despite the extreme cold, the molecules reacted quickly in their icy forms. "At 130 Kelvin [about -143°C], which represents the warm end of the expected temperatures on Europa, this reaction is essentially instantaneous," says Loeffler. "At 100 Kelvin, you can saturate the reaction after half a day to a day. If that doesn't sound fast, remember that on geologic timescales - billions of years - a day is faster than the blink of an eye."

To test the reaction, the researchers added frozen carbon dioxide, aka dry ice, which is commonly found on icy bodies, including Europa. "If frozen carbon dioxide had blocked the reaction, we wouldn't be nearly as interested," explains Hudson, "because then the reaction probably wouldn't be relevant to Europa's chemistry. It would be a laboratory curiosity." But the reaction continued, which means it could be significant on Europa as well as Ganymede and Callisto, two more of Jupiter's moons, and other places where both water and sulfur dioxide are present.

The reaction converted one-quarter to nearly one-third of the sulfur dioxide into product. "This is an unexpectedly high yield for this chemical reaction," says Loeffler. "We would have been happy with five

percent." More importantly, the positive and negative ions produced will react with other molecules. This could lead to some intriguing chemistry, especially because bisulfite ( $\text{HSO}_3^-$ ), a type of sulfur ion, and some other products of this reaction are refractory - stable enough to stick around for a while.

Robert Carlson, who is a senior research scientist at NASA's Jet Propulsion Laboratory in Pasadena, Calif., and collaborates with the two researchers, notes that earlier hints of water and sulfur dioxide reacting as solids were found but not explained. "The Loeffler and Hudson results show that really interesting acid-base reactions are going on," he says. "I am anxious to see what might happen when other species are added and how the minor concentrations of sulfur dioxide on the satellite surfaces affect the overall chemistry."

The ultimate test of the laboratory experiments will be whether evidence of any reaction products can be found in data collected during remote observations or future visits to Europa. Johnson agrees that if subsurface sulfur dioxide on Europa "reacts to form refractory species, as [the researchers] indicate, then the picture changes completely. This not only will affect our understanding of Europa but also will affect the models used to develop instruments for the proposed Jupiter-Europa Orbiter mission."

### **Scratched glasses give perfect vision for any eyesight**

\* 04 October 2010 by **Jeff Hecht**

DITCH those bifocals. You might soon be wearing spectacles whose lenses allow you to see clearly regardless of how long or short-sighted you are.

With age, the lenses in our eyes often lose the ability to change shape enough to focus light from near objects onto the retina - a condition called presbyopia. This leaves people who were already short-sighted unable to focus on either near or distant objects. Bifocals offer a solution by having two lenses in the same frame, but users must get used to tilting their head up or down to switch focus.

Zeev Zalevsky at Bar-Ilan University in Ramat Gan, Israel, has developed a technique to turn a standard lens into one that perfectly focuses light from anything between 33 centimetres away and the horizon.

It involves engraving the surface of a standard lens with a grid of 25 near-circular structures each 2 millimetres across and containing two concentric rings. The engraved rings are just a few hundred micrometres wide and a micrometre deep. "The exact number and size of the sets will change from one lens to another," depending on its size and shape, says Zalevsky.

The rings shift the phase of the light waves passing through the lens, leading to patterns of both constructive and destructive interference. Using a computer model to calculate how changes in the diameter and position of the rings alter the pattern, Zalevsky came up with a design that creates a channel of constructive interference perpendicular to the lens through each of the 25 structures. Within these channels, light from both near and distant objects is in perfect focus.

"It results in an axial channel of focused light, not a single focal spot," Zalevsky says. "If the retina is positioned anywhere along this channel, it will always see objects in focus."

Zalevsky has fitted one of his lenses to a cellphone camera to confirm the extended focus effect, and he has also tested the lenses on 12 volunteers (*Optics Letters*, vol 35, p 3066). He has now co-founded a company, Xceed Imaging, to develop the technology.

The approach is not without its problems, though: the interference pattern tends to cancel out some of the light passing through the lens, which reduces the contrast of images viewed through it. Pablo Artal of the University of Murcia, Spain, warns that if the contrast reduction becomes too large, the brain will struggle to interpret the information.

Zalevsky counters that people wearing the lenses do not notice a loss in contrast because the eye is very sensitive to light at low intensity. "Unlike a camera, the brain has a logarithmic and not linear [response to light]." He says that the brain adapts to and minimises the reduced contrast within a few seconds.

This is not the only way in which the brain must adapt to the new lenses. Fixed in a pair of glasses, the lenses would not move as the eye looked in different directions, so the focusing effect would be lost in the regions between the circles. But Zalevsky says that the eye learns to fill in the gaps as it moves from one engraved structure to another, generating a continuous effect.

### **Researcher finds top reasons for Facebook unfriending** ***Posting about religion and politics risky***

DENVER - With over 500 million users worldwide, Facebook has become a global phenomenon, a vast cyber neighborhood where friends meet to share photos, news and gossip.

But when those relationships sour, another phenomenon often occurs – unfriending.

In what may be the first comprehensive study of its kind, a University of Colorado Denver Business School student has revealed the top reasons for Facebook unfriending, who is unfriended and how they react to being unfriended.

"Researchers spend a lot of time examining how people form friendships online but little is known on how those relationships end," said Christopher Sibona, a PhD student in the Computer Science and Information Systems program whose research will be published January by the Hawaii International Conference on System Sciences. "Perhaps this will help us develop a theory of the entire cycle of friending and unfriending."

After surveying more than 1,500 Facebook users on Twitter, Sibona found the number-one reason for unfriending is frequent, unimportant posts.

"The 100th post about your favorite band is no longer interesting," he said.

The second reason was posting about polarizing topics like religion and politics.

"They say not to talk about religion or politics at office parties and the same thing is true online," he said.

Inappropriate posts, such as crude or racist comments, were the third reason for being unfriended.

The study showed 57 percent of those surveyed unfriended for online reasons, while 26.9 percent did so for offline behavior.

Sibona found a sort of online hierarchy of dominant and subordinate relationships. For example, those making friend requests stood a much higher chance of being abruptly unfriended.

At the same time, those doing the unfriending seemed to hold the upper hand in the relationship.

It's a delicate dance with its own rules or "netiquette," far different from face-to-face interaction.

"There is a lot more nuance in the offline friendship world. You don't have to go up to someone and ask them to be your friend," Sibona said. "That's not the case online. It can be awkward."

An AOL study showed 30 percent of teenagers wanted to unfriend their own parents. Sibona found two users who actually did this. One later refriended his mom but put her on a limited profile so he could manage her online interactions.

While some respondents reported being deeply hurt at being unfriended, others were more amused than traumatized. "There are a wide variety of reactions depending on who did the unfriending and why," he said.

Facebook, founded in 2004 by Mark Zuckerberg, is so ingrained in popular culture that in 2009 unfriend was named word of the year by the New Oxford American Dictionary, which defined it as "to remove someone as a 'friend' from a social networking site such as Facebook." A movie about Zuckerberg, *The Social Network*, was released last week.

Given the public nature of Facebook profiles, Sibona urged users to exercise caution in their posting behaviors citing a 2010 survey showing that 54.6 percent of recruiters used the site to find or investigate job candidates. "The same kinds of posts that could get you unfriended might also be viewed negatively by recruiters," he said.

Steven Walczak, associate professor of Information Systems at the University of Colorado Denver Business School and Sibona's advisor, said he hopes the study will spark further research.

"With businesses embracing Facebook as a marketing and customer-relationship tool, this will hopefully create new research that further examines how social networks enhance business decision making and outcomes," he said.

### **2009 H1N1 pandemic -- what went right and what went wrong?**

In this week's PLoS Medicine, Gabriel Leung from the Government of the Hong Kong SAR and Angus Nicoll from the European Centre for Disease Prevention and Control offer their reflections on the international response to the 2009 H1N1 influenza pandemic, including what went well and what changes need to be made on the part of global and national authorities in anticipation of future flu pandemics.

**FREELY AVAILABLE PAPER:** <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000346>

#### **Summary Points**

- \* Many of the initial responses to the 2009 H1N1 pandemic went well but there are many lessons to learn for future pandemic planning.

- \* Clear communication of public health messages is crucial, and should not confuse what could happen (and should be prepared for) with what is most likely to happen.

- \* Decisions regarding pandemic response during the exigencies of a public health emergency must be judged according to the best evidence available at the time.

- \* Revising pandemic plans - to be more flexible and more detailed - should wait for WHO leadership if national plans are not to diverge. Surveillance beyond influenza should be stepped up, and contingencies drawn up for the emergence or re-emergence of other novel and known pathogens.

- \* Data collection and sharing are paramount, and include epidemiological and immunological data. Clinical management of severe influenza disease should not be limited to the current antiviral regimen, and include the development of other therapeutics (e.g., novel antivirals and immunotherapy).

- \* Greater and more timely access to antivirals and influenza vaccines worldwide remains an ongoing challenge.

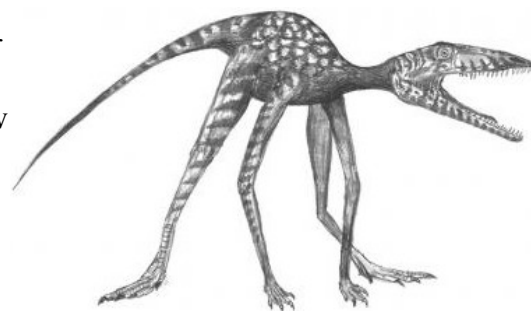
**Funding:** No specific funding was received for this article.

**Competing Interests:** The views expressed are those of the authors and not necessarily those of the Food and Health Bureau, Government of the Hong Kong SAR, European Centre for Disease Prevention and Control. Each of the authors declares no conflict of interest, financial or otherwise. AN is on long-term secondment to ECDC from the UK Health Protection Agency.

**Citation:** Leung GM, Nicoll A (2010) Reflections on Pandemic (H1N1) 2009 and the International Response. *PLoS Med* 7(10): e1000346. doi:10.1371/journal.pmed.1000346

## **Oldest evidence of dinosaurs found in Polish footprints** **Dinosaur lineage emerged soon after massive Permian extinction**

The oldest evidence of the dinosaur lineage - fossilized tracks - is described this week in *Proceedings of the Royal Society B*. Just one or two million years after the massive Permian-Triassic extinction, an animal smaller than a house cat walked across fine mud in what is now Poland. This fossilized trackway places the very closest relatives of dinosaurs on Earth about 250 million years ago - 5 to 9 million years earlier than previously described fossilized skeletal material has indicated. The paper also described the 246-million-year-old *Sphingopus* footprints, the oldest evidence of a bipedal and large-bodied dinosaur.



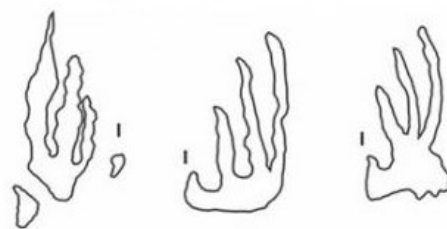
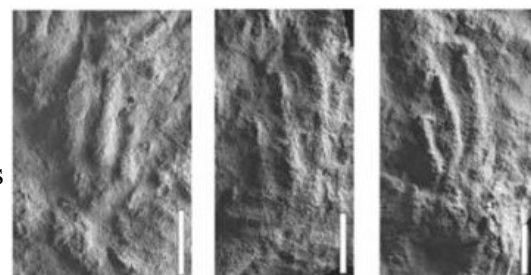
***This is a reconstruction of cat-sized stem dinosaur Prorotodactylus isp. found in Stryczowice, Poland that was a quadruped with a dinosaur-like gait and orientation of the toes.* Grzegorz Niedźwiedzki**

"We see the closest dinosaur cousins immediately after the worst mass extinction," says Stephen Brusatte, a graduate student affiliated with the Division of Paleontology at the American Museum of Natural History. "The biggest crisis in the history of life also created one of the greatest opportunities in the history of life by emptying the landscape and making it possible for dinosaurs to evolve."

The new paper analyzes three sets of footprints from three different sites in the Holy Cross Mountains of central Poland. The sites, all quarries within a 25-mile radius of each other, are windows into three ecosystems because they represent different times periods. The Stryczowice trackway is the oldest at 250 million years. The Baranów trackway is the most recent at 246 million years of age while the Wióry trackway is sandwiched in time between the others.

Because footprints are only an imprint of a small part of the skeleton, identification of trackmakers is often tricky. Luckily, dinosaurs have a very distinctive gait, especially when compared to their diapsid relatives (the evolutionary group that includes birds, reptiles, and extinct lineages) like crocodiles and lizards. While lizards and crocodiles have a splayed walking style, dinosaurs place their two feet closer together. The footprints at all three Polish sites show this feature as well as indisputable dinosaur-like features, including three prominent central toes and reduced outer two toes, a parallel alignment of these three digits (a bunched foot), and a straight back edge of footprints, additional evidence of a dinosaur-like simple hinged ankle.

Because all of these features are seen in footprints at the oldest site, Brusatte and colleagues conclude that the Stryczowice prints - which are only a few centimeters in length - are the oldest evidence of the dinosaur lineage.



***The 250 million year old footprints of Prorotodactylus isp. from the Early Olenekian of Stryczowice, Poland show reduced digits I and V and parallel three middle digits, traits of the dinosaur-lineage. The gait, though, was quadrupedal. These are the oldest known fossils of the dinosaur lineage.* Grzegorz Niedźwiedzki**

These dinosaurs, though, are considered "stem dinosaurs," or the immediate relatives of dinosaurs not part of the slightly more derived clade that technically defines dinosaurs. Also, this animal did walk on all four limbs, an abnormal posture for early dinosaurs and their close relatives, although it appears that its forelimbs were already being reduced to more dinosaur-like proportions since the footprints overstep handprints.

The Baranów and Wióry trackways show changes early in the evolutionary history of dinosaurs. Wióry at 248 million years ago shows slight diversification in the types of tracks, but all tracks remain quadrupedal. Footprints from Baranów at 246 million years ago, however, may be the earliest evidence of moderately large-bodied and bipedal true dinosaurs. These tracks, which are called *Sphingopus*, are 15 centimeters long.

"Poland is a new frontier for understanding the earliest evolution of dinosaurs," says Grzegorz Niedźwiedzki of the University of Warsaw and the Polish Academy of Sciences, who led the project and has been excavating

footprints from the three sites for nearly a decade. "It used to be that most of the important fossils were from Argentina or the southwestern U.S., but in Poland we have several sites that yield footprints and bones from the oldest dinosaurs and their closest cousins, stretching throughout the entire Triassic Period."

Finally, although the dinosaur group emerged soon after the Permian extinction, dinosaur-like tracks are rare in the footprint assemblages, representing only 2 percent of the prints discovered as opposed to 40 percent for crocodile-like archosaurs. Dinosaurs became more abundant tens of millions of years later.

"For the first 20 million years of dinosaur history, dinosaurs and their closest relatives were living in the shadow of their much more diverse, successful, and abundant crocodile-like cousins," says Brusatte. "The oldest dinosaurs were small and rare."

*In addition to Brusatte and Niedzwiedzki, Richard Butler of the Bayerische Staatssammlung für Paläontologie und Geologie in Germany was an author of the paper. Brusatte is also affiliated with Columbia University. The research was funded in part by the National Science Foundation, the Percy Sladen Fund, the Alexander von Humboldt Research Fellowship, and the University of Warsaw*

### **Low testosterone linked to Alzheimer's disease**

#### **Saint Louis University geriatrician collaborates on year-long study of Chinese older men**

ST. LOUIS -- Low levels of the male sex hormone, testosterone, in older men is associated with the onset of Alzheimer's disease, according to research by a team that includes a Saint Louis University scientist.

"Having low testosterone may make you more vulnerable to Alzheimer's disease," said John E. Morley, M.D., director of the division of geriatric medicine at Saint Louis University and a study co-investigator. "The take-home message is we should pay more attention to low testosterone, particularly in people who have memory problems or other signs of cognitive impairment."

The study was published electronically in the Journal of Alzheimer's Disease and led by Leung-Wing Chu, M.D., who is chief of the division of geriatric medicine at Queen Mary Hospital at the University of Hong Kong.

Researchers studied 153 Chinese men who were recruited from social centers. They were at least 55 years and older, lived in the community and didn't have dementia. Of those men, 47 had mild cognitive impairment – or problems with clear thinking and memory loss.

Within a year, 10 men who all were part of the cognitively impaired group developed probable Alzheimer's disease. These men also had low testosterone in their body tissues; elevated levels of the ApoE 4 (apolipoprotein E) protein, which is correlated with a higher risk of Alzheimer's disease; and high blood pressure. "It's a very exciting study because we've shown that a low level of testosterone is one of the risk factors for Alzheimer's disease," Morley said.

The findings corroborate findings in previous studies of older Caucasian men that show low testosterone is associated with impaired thinking and Alzheimer's disease. They suggest that testosterone may have a protective value against Alzheimer's disease.

The next step, Morley said, is to conduct a large-scale study that investigates the use of testosterone in preventing Alzheimer's disease. Morley and his co-authors advocate studying the effectiveness of testosterone replacement in older men who have both mild memory problems and low testosterone in staving off Alzheimer's disease.

### **Awareness: Killer of 200,000 Americans, Hardly Noticed**

**By RONI CARYN RABIN**

Sepsis causes more than 200,000 deaths in the United States each year, yet Americans know little about it: most people questioned online for a new study said they had never heard the term.

The illness develops when the immune system's response to an infection spins out of control, causing severe injury to other organs in the body. Early symptoms may include chills, confusion, abnormal body temperature, rapid heart rate, low blood pressure and rash; a quick diagnosis is critical to preventing deaths.

The new study, of 1,000 Americans 18 and older questioned in late August and early September, found that 3 out of 5 were not familiar with the term. Among older adults, who are at higher risk, the percentage was even higher.

The study, commissioned by the Feinstein Institute for Medical Research, part of the North Shore-Long Island Jewish Health System, was carried out by APCO Insight, an international research firm, and released last week.

Raising awareness is critical to reducing the number of sepsis deaths, said Dr. Kevin J. Tracey, the institute's president. People should be able to identify the very early signs of the illness, just as they have learned to be vigilant for symptoms of a heart attack.

"If someone has an infection on the arm or leg, and then develops a fever, or starts to feel sick all over," he said, "someone should say, 'I'm concerned about sepsis.'"

## Why Indiscretions Appear Youthful

By **BENEDICT CAREY**

She had every reason to start stealing, or so it seemed at the time. A young daughter at home. Sickly, dependent in-laws. No savings or decent income. She and her husband could barely make the rent, and here she was working at a large department store that was raking in the cash. Who would miss a few items here and there, a jacket, some cosmetics?

It was easy, too. Fake a purchase, slip the thing into a bag and walk out at the end of the day with something extra: a small donation to a worthy charity, the struggling American family.

"I knew it was wrong and I knew I would probably get caught," said the thief, a woman in the Los Angeles area, who recently recounted her 1980s spree (anonymously, for obvious reasons) to researchers studying moral choices. She added, "After that, I really made up my mind that I was going to get my life together and get on track."



**Brian Stauffer**

In recent years psychologists have exposed the many ways that people subconsciously maintain and massage their moral self-image. They rate themselves as morally superior to the next person; overestimate the likelihood that they will act virtuously in the future; see their own good intentions as praiseworthy while dismissing others' as inconsequential. And they soften their moral principles when doing a truly dirty job, like carrying out orders to exploit uninformed customers.

Now, scientists are beginning to learn how memory assists and even amplifies this righteous self-messaging. In piecing together a life story, the mind nudges moral lapses back in time and shunts good deeds forward, these new studies suggest - creating, in effect, a doctored autobiography. Recognizing this tendency in oneself, psychologists say, can both reduce the risk of lapsing into middle-aged sanctimony and increase moral vigilance for when it matters most: the present.

"We can't make up the past, but the brain has difficulty placing events in time, and we're able to shift elements around," said Anne E. Wilson, a social psychologist at Wilfrid Laurier University in Waterloo, Ontario. "The result is that we can create a personal history that, if not perfect, makes us feel we're getting better and better."

In a new paper in the journal *Emotion*, which included the tale of the department store thief, neuroscientists at Caltech provide perhaps the richest documentation of this effect to date. They recruited 100 people, ages 40 to 60, to participate in what was described as a memory study. In response to dozens of prompts - "Please talk about a time when you did something that made you feel guilty," for instance - they poured out memories.

The researchers transcribed the recorded tales and created a database of 758 "moral memories" by singling out those that had clear moral content, whether positive or negative. One person confessed to poaching a pad of Post-it notes from an employer, another to stealing books while growing up poor in Mexico. A third admitted cheating on her husband with the neighbor. A former drug addict recalled holding a knife to a man's throat in a robbery. ("I just remember that rush - it gave me a sense of great power.")

The database provides a detailed catalog of bad and good behavior, as well as a rough guide to what people consider most shameful. The most common bad acts were also some of the most regretted: stealing, followed by cheating (whether on a romantic partner or on a test) and lying.

To complete the study, the participants returned weeks later and rated each of their own tales on a variety of scales, including the emotions they felt at the time and the estimated date when the episode happened. After correcting for age at the time of memories (in other words, trying to take account of the lunacy of youth) the researchers identified a clear pattern: people dated their memories of moral failings about 10 years earlier, on average, than their memories of good deeds, according to Jessica R. Escobedo, co-author of the paper with Ralph Adolphs.

"The main finding is that if I ask you to tell me about a positive moral memory, you'll tell me something recent," Dr. Escobedo said. "If I ask you to tell me about bad moral memory, you're going to give me something from much further in the past."

Dr. Adolphs and Dr. Escobedo, now at Charles Drew University in Los Angeles, argue that to talk about moral lapses at all, people first needed time to reimagine themselves as having evolved - as being a different person from the one who fleeced his customers, lied to her spouse or snatched a few purses over at the senior center.

“People honestly view their past in a morally critical light, but at the same time they tend to emphasize that they have been improving,” the authors concluded.

Other researchers note that many unpleasant events feel more distant than they actually are, not just morally charged ones. Students who did poorly on an exam sense the experience as further in the past than tests on which they did well, and took at about the same time. The same goes for memories of high school among young adults: those who hated their time in those locker-lined hallways feel further from their teenage selves than those who enjoyed it.

But the mind seems particularly prone to backdating when it comes to cruel, greedy or cowardly acts - the physical evidence people weigh against stand-up deeds to judge whether they are as good as their parents told them they were. In a 2001 paper titled “From Chump to Champ,” Dr. Wilson and Michael Ross of the University of Waterloo demonstrated in a series of experiments that young adults described their teenage selves in far more negative terms than they did their current selves, often skewering their past judgment.

Future selves may score the best reviews of all, said David Dunning, a social psychologist at Cornell. “People seem to situate themselves in time differently than they do others,” Dr. Dunning wrote in an e-mail. “Ask students what’s important for gaining an accurate impression of them and they emphasize more their unwritten future potential than they do when asked the same question about another person. We presume that future potential is more rosy than the past is.”

The psychologically buoying effect of such ascending-toward-heaven autobiographies is obvious. But redemption is also a thematic staple of the life stories that content American adults tell about themselves, said Dan McAdams, a psychologist at Northwestern and the author of “The Redemptive Self.” Such stories “are so much a part of the culture we grow up with as Americans that they seem ‘natural,’ ” Dr. McAdams said by e-mail. “But is this how people narrate their lives in all other societies?”

Probably not - at least not the happy ending, he said. But people from any society on earth would certainly recognize the first chapters, the moral stumbles, whether backdated or not.

“The weirdest thing about reading about all these bad moral choices,” Dr. Escobedo said, “is that it makes you kind of feel good about yourself. Just seeing how everyone makes mistakes and regrets not doing what was morally right: It makes you feel more attached to humanity.”

### **99 year old Skyper shows why aged care facilities should offer internet access**

(PhysOrg.com) -- Internet access should be mandatory in all aged care facilities, according to a University of Melbourne expert.

Currently, only a handful of facilities offer internet access to residents. However, Dr John Murnane from the Melbourne Graduate School of Education said this wasn't enough.

“Internet access provides an important opportunity for mental stimulation, which is closely tied to older people’s health,” said Dr Murnane. “It is also a liberating outlet for those confined to a single building on a day-to-day basis. Everyone living in retirement facilities deserves to experience these benefits.”

Dr Murnane’s research in a low-care hostel in Melbourne has shown that, while there are many challenges, older people can learn to use computers and access email, and derive huge benefits from doing so.

“The residents I work with are all over the age of 85. I’ve been working with them since 2007, and now many of them can use email by themselves. The oldest participant, who is 99, is currently learning to Skype, to keep in touch with relatives in France,” he said.

“Email is the most popular activity among our participants, with its ability to send photographs particularly valued. However, some participants are also developing an interest in researching family histories online, and the group has a growing Facebook presence.”

Dr Murnane disputed widely-held beliefs that residents of aged care facilities and other elderly people were too old to learn to use the internet.

“The way we talk about the internet, for example by referring to digital natives and immigrants, helps to build a culture of fear among the non-computer literate. We need to stop thinking about the internet as the preserve of the young; indeed, the way the world wide web enables us to explore, learn and communicate might have been especially designed for the elderly or disabled.”

Dr Murnane said it was likely aged care facilities would face increasing pressure to introduce the internet in the next five to 10 years, as a growing number of computer-literate residents moved in.

“Although making internet access available can be costly and resource-intensive for aged care facilities, I believe the benefits certainly outweigh the costs. They shouldn’t have to wait for residents to demand internet access. Current residents deserve access now,” he said.

## White House Going Solar - Again

By JOHN M. BRODER Green: Politics

The White House, which only last month rebuffed a proposal by activists to reinstall one of former President Carter's solar panels atop the executive mansion, plans to announce Tuesday that it will be adopting solar power after all.

Nancy Sutley, chairman of the White House Council on Environmental Quality, and Steven Chu, the energy secretary, will unveil plans to place photovoltaic solar collectors and a solar hot water heater atop 1600 Pennsylvania Avenue to heat water and provide a small amount of electricity for the residence.

"This project reflects President Obama's strong commitment to U.S. leadership in solar energy and the jobs it will create here at home," Secretary Chu said in a statement. "Deploying solar energy technologies across the country will help America lead the global economy for years to come."

President Ronald Reagan dismantled Mr. Carter's solar array in 1986, but the first President Bush installed a modest solar system to power a maintenance building and heat the White House swimming pool.

The announcement is part of a broader administration push to promote renewable energy and reduce emissions of climate altering gases produced by fossil fuels. Interior Secretary Ken Salazar is expected to announce Tuesday that he is approving two large solar collection systems in the California desert. The Interior Department is also making plans for a series of offshore wind generation farms off the East Coast.

The president, who has said that addressing climate change is one of his top priorities, is taking such unilateral steps because Congress has failed to act on comprehensive climate and energy legislation.

Bill McKibben, the climate change activist who drove the Carter solar panel to Washington from Maine last month and asked the White House to put it on the roof, said Tuesday he was thrilled that the White House had seen the light.

"The White House did the right thing, and for the right reasons: they listened to the Americans who asked for solar on their roof, and they listened to the scientists and engineers who told them this is the path to the future," Mr. McKibben said in a statement. "If it has anything like the effect of the White House garden, it could be a trigger for a wave of solar installations across the country and around the world."

The solar power industry also applauded the White House action as a symbolic sign of its commitment to renewable energy.

"As we enter the second decade of the 21st century experiencing a horrific oil spill in the Gulf of Mexico, a devastating natural gas explosion in California, death of 25 West Virginia coal miners, kidnapped uranium miners in Niger - it's about time for the United States to reposition itself as a global leader in solar and the entire portfolio renewable energy and energy efficiency technologies critical to our economic and national security," said Scott Sklar, president of the Stella Group, which promotes renewable power generation.

## New Kind of Uranium Could Power Your Car

***Nuclear power may go portable with this new form of uranium.***

By Eric Bland | Tue Oct 5, 2010 01:45 PM ET

A newly discovered form of uranium could lead to a nuclear power plant small enough to fit in your car and eventually even power it. Scientists from the Los Alamos National Laboratory have created a long-sought molecule known as uranium nitride. Besides offering cheaper and safer nuclear fuel, the new molecule could extract more energy from fossil fuels, making cars more fuel-efficient, and could also lead to cheaper drugs.

"Actinide nitrides are candidate nuclear fuels of the future," said Jaqueline Kiplinger, a scientist at the Los Alamos National Laboratory who led the team of researchers on the recent Nature Chemistry paper. "But they can also break carbon-hydrogen bonds, which are very strong."

Uranium nitride rips the hydrogen atoms off a carbon atom -- no easy task.

A similar process happens every day in car engines. Unfortunately a lot of energy in those bonds is lost as heat.

If the two atoms could be split apart without losing all that energy, gasoline could be used much more effectively not only to fuel a car, but also to improve a whole variety of petroleum-related products, from plastics to drugs.

Unfortunately the new molecule is destroyed when it rips hydrogen atoms off a carbon atom. For uranium nitride to become commercially viable, it would have to knock one hydrogen atom after another and not destroy itself in the process. The scientists would, in other words, have to turn uranium nitride into a catalyst. That should be possible, said Kiplinger, but right now it is not.

Scientists might not have a cheap, reliable and reusable molecular bond-breaker, but nature already does. Found in virtually every organism on Earth, cytochrome P450 is an enzyme involved in a massive number of chemical transformations, from creating energy in mitochondria to drug metabolism.



"Our studies suggest that uranium nitride breaks carbon-hydrogen bonds like cytochrome P450," said Kiplinger.

By studying exactly how uranium nitride breaks C-H bonds, scientists could learn more about how cytochrome P450 breaks C-H bonds, a process which, despite its biological and potential economic importance, is poorly understood.

"For me the most interesting aspect of this new molecule is its chemistry," said Trevor Hayton, a scientist at the University of California, Santa Barbara, who was not involved in the Los Alamos National Laboratory study. "But one motivation to create this new molecule is its proposed use as a new nuclear fuel."

Uranium nitride could lead to smaller, cheaper and even portable nuclear power plants. NASA, Hyperion Power Generation and other organizations are all looking at using uranium nitride as a next generation nuclear fuel in their reactors.

Despite uranium's association with deadly radiation, the new molecule contains depleted uranium, which is relatively harmless from a radiological standpoint and offers many opportunities in catalytic and industrial applications.

The ability to quickly and reliably destroy carbon-hydrogen bonds could make drugs and other industrially important chemicals cheaper. Many of these compounds are petroleum-based. It takes high temperatures, high pressures and multiple steps to refine oil into everyday items. If this new molecule could do the job at room temperature, room pressure and in a single step, it would save time and money.

### **Light drinking no risk to baby, say researchers**

#### ***Pregnant woman drinking Official advice remains that women should not drink during pregnancy***

Drinking one or two units of alcohol a week during pregnancy does not raise the risk of developmental problems in the child, a study has suggested. Official advice remains that women abstain completely during pregnancy. A study of more than 11,000 five-year-olds published in the Journal of Epidemiology and Community Health found no evidence of harm. There were more behavioural and emotional problems among the children of heavy-drinking women.

When a pregnant woman drinks alcohol, it passes through the placenta and reaches the baby, which is less well-equipped to break it down. Researchers have strongly linked heavy drinking to an increased risk of lifelong damage. However, the evidence about the risks to lighter drinkers has been far less clear.

Mothers at a toddler's music group in Leeds received mixed messages

The study, led by University College London but involving three other UK universities, is the second by this group examining large numbers of children looking for signs that brain development had been affected.

#### **No extra risk**

The first had found no evidence of problems at age three, but the latest study extended the checks until school age to make sure nothing had emerged later. The same result appeared, with no extra risk of behavioural and emotional issues compared with children whose mothers had abstained during pregnancy. In fact, the children born to light drinkers appeared slightly less likely to suffer behavioural problems, and scored higher on cognitive tests, compared with women who stopped during pregnancy.

Dr Yvonne Kelly, from UCL, said: "There's now a growing body of robust evidence that there is no increase in developmental difficulties associated with light drinking during pregnancy." She said that women could make "better decisions" with this information.

However, a spokesman for the Department of Health said that its advice would remain unchanged to avoid confusion among pregnant women. "After assessing the available evidence, we cannot say with confidence that drinking during pregnancy is safe and will not harm your baby.. "Therefore, as a precautionary measure, our advice to pregnant women and women trying to conceive is to avoid alcohol."

Additional advice from the National Institute of Health and Clinical Excellence urges women to avoid alcohol, particularly in the first three months of pregnancy.

This advice was backed by Chris Sorek, the chief executive of alcohol awareness charity Drinkaware.

He said: "Despite these findings, it is important to remember that 'light drinking' can mean different things to different people. "There is a risk that if pregnant women take this research as a green light to drink a small amount, they could become complacent, drink more than they think they are and inadvertently cause harm to their unborn child. "Excessive drinking during pregnancy can carry serious consequences and lifelong damage to children and should be avoided."

But Dr Tony Falconer, the president of the Royal College of Obstetricians and Gynaecologists, said that while the "safest choice" was abstinence, the current evidence suggested that drinking one or two units, once or twice a week was acceptable. "The key public health message, whether or not a woman is pregnant, is that light drinking is fine, but heavy and binge drinking should be avoided."

## Effects of volcanic eruption dash promising global warming theory

Justine Hunter

When the Coast Guard research vessel John P. Tully churned across the North Pacific in the summer of 2008, scientists on board discovered an anomaly on a microscopic scale. Tiny ocean plants called phytoplankton were blooming like crazy.

By sheer luck, the ship was sailing through an event that temporarily turned the North Pacific Ocean into a colossal lab experiment. The findings – published Tuesday by a Canada-U.S. team led by University of Victoria oceanographer Roberta Hamme – have dashed a hopeful theory: that sprinkling iron into oceans to stimulate phytoplankton growth might reverse the effects of global warming.

A massive growth in phytoplankton was triggered following the eruption of the Kasatochi volcano in August.

*The eruption of the Kasatochi volcano, a series of explosive blasts that lasted two days in August, with gas and ash clouds spreading across Canada and the continental United States, triggered a massive growth in phytoplankton.*  
(Alaska Volcano Observatory/ The Globe and Mail)



The largest phytoplankton bloom recorded since satellite monitoring began in 1997 was triggered by a series of explosive volcanic eruptions on the remote island of Kasatochi, part of Alaska's Aleutian Islands chain.

In just 25 hours, the volcano spewed as much as a quarter of a cubic kilometre of material, with gas and ash clouds spreading across Canada and the continental United States. The once-lush island, home to hundreds of thousands of seabirds, was buried under debris tens of metres thick.

Then a perfectly timed storm swept volcanic ash out to sea, sprinkling iron-rich particles across a 1,000-kilometre stretch of the Pacific. The phytoplankton literally ate it up – and thrived.

The free-floating, single-celled plants – the foundation of the marine food chain – absorb carbon dioxide (CO<sub>2</sub>) when they die, effectively creating a carbon sink in the ocean depths. Based on that knowledge, scientists have suggested that seeding key regions of the ocean with iron could offset carbon dioxide in the atmosphere.

But the phytoplankton bloom in 2008 had only a modest impact on CO<sub>2</sub> levels, Prof. Hamme concluded.

Earth's oceans naturally absorb about two petagrams of carbon annually – compared to the estimated 6.5 petagrams of carbon released each year by fossil fuel consumption. (A petagram is one of those mind-numbing measurements that has too many zeros to really grasp – 15 in all.) The huge plankton bloom barely nudged the meter – Prof. Hamme estimates it absorbed 0.01 petagrams of carbon.

“It tells us the amount of iron we would have to put into the ocean would just be gigantic, and it disappeared so fast, you'd have to keep putting it in over and over again,” she said in an interview.

Prof. Hamme said the unique events of the huge Kasatochi volcano provided a natural test lab that would be almost impossible to reproduce. But it was also a perfect storm of scientific monitoring that helped capture the data. The John P. Tully makes its trek to Station Papa, a spot in the middle of the Pacific, three times each year to gather data. New monitoring equipment also happened to be deployed in the right spots at the right time. In all, her paper published in *Geophysical Research Letters* cited 20 different data sets.

The connection between the plankton bloom and the volcano wasn't immediately obvious. Prof. Hamme brought her odd readings to a conference at the Institute of Ocean Sciences in Sidney, B.C., in the spring of 2009. “Each person came to talk about their data set, they all got up and said, ‘Here's something different.’ We started brainstorming, and someone mentioned volcanoes. I didn't think it was that, I laughed.”

It wasn't until months later, when she was researching the Aleutian Islands and came across a video of the Aug. 7-8, 2008, eruption of Kasatochi volcano, that she realized the potential for one substantial disruption to explain the other. “It all came together,” she said.

### Powerful Free Radical Causes Lung Damage from Oxygen Therapy

The most toxic free radical appears responsible for much of the lung damage that can result from oxygen therapy in the critically ill or injured, Medical College of Georgia researchers report. Within just a few days, ventilators and oxygen chambers used to significantly increase oxygen levels can also dramatically increase levels of peroxynitrite, an oxidant powerful enough to break down DNA and cause proteins to malfunction, said Dr. Yunchao Su, pharmacologist in the MCG Schools of Medicine and Graduate Studies.

Oxygen toxicity is the most severe side effect of oxygen therapy in newborns and adults. The lungs take the brunt of the damage, which can include inflammation, hemorrhaging and swelling that may result in death or

chronic lung problems, said Su, corresponding author of the study published in the Journal of Biological Chemistry.

"We knew it was bad but we did not know why," Su said. The good news is they may also have a solution.

Researchers found that within five days, mice placed in small oxygen chambers that mimic oxygen levels given in intensive care have dramatically elevated levels of peroxynitrite in their lungs. Free radicals, such as peroxynitrite, result from oxygen use and are safe at low levels. While it's a given that oxygen therapy produces free radicals, the significant increase in peroxynitrite was not known.

The trouble begins when high oxygen levels prompt endothelial cells that line blood vessels and tiny air sacs in the lung to make more nitric oxide, the precursor of peroxynitrite. At high levels, nitric oxide, most often a helpful compound, combines with other free radicals produced by excess oxygen use to form the powerful peroxynitrite. "As oxygen levels increase, nitric oxide levels increase and so peroxynitrite levels do as well," Su said.

But he appears to have identified a break point in the destructive cycle. Su found that in the face of high oxygen levels, the enzyme that makes nitric oxide binds with the protein actin to produce more nitric oxide. So he developed a compound, peptide 326, that interferes with their binding and the excess peroxynitrite levels that typically follow. Su used the binding site itself as a cue for the peptide design after trying many existing compounds, including smoke, to break the bond.

Su's long term goal is for peptide 326, or something similar, to be used in patients likely after the first few days of oxygen therapy. Much as health care providers monitor blood oxygen long term to ensure sufficient levels, they could also monitor peroxynitrite levels. "It's only after several days of steady increases that the level becomes destructive," Su noted.

MCG scientists are already using peptide 326 in mice receiving oxygen therapy.

*The research was funded by the National Institutes of Health, the American Heart Association and the Flight Attendants Medical Research Institute.*

*Dr. Dmitry Kondrikov, assistant research scientist at MCG, is first author of the paper; graduate student Shawn Elms and vascular biologist Dr. David Fulton are co-authors.*

## **In Parkinson's Disease, Brain Cells Lose 'Powerhouses'**

**By Rachael Rettner**, MyHealthNewsDaily Staff Writer

The brain cells of patients with Parkinson's disease undergo a shutdown of their energy powerhouses, the mitochondria, according to a new study. Because this shutdown probably occurs early in Parkinson's cases, the finding could lead to therapies that stop the disease before too much damage has been done.

Researchers identified 10 groups of genes - called gene sets, each carrying out one biological process - associated with Parkinson's disease. Many of these gene sets are involved in helping the mitochondria do their job. Even in people whose autopsies revealed early Parkinson's - who did not have clinical symptoms, but whose brains showed signs of the disease - these gene sets were not expressed properly, meaning the mitochondria in those cells probably weren't working.

The loss of working mitochondria, which produce most of the cell's energy, may contribute to the onset of the disease, the researchers said. All of these gene sets are controlled by a single gene, a "master regulator" called PGC-1alpha that switches the gene sets on or off.

This gene could be a target for future therapies to treat or prevent the disease, the researchers said. Their results are published today (Oct. 6) in the journal Science Translational Medicine.

### **Parkinson's genes**

Parkinson's affects about 5 million people globally. The disease kills brain cells that produce the chemical dopamine. This impairs patients' movements, causing symptoms such as tremors, muscle stiffness and impaired balance and coordination. The cause of the disease is not known.

Clemens Scherzer, of Brigham and Women's Hospital and Harvard Medical School, and his colleagues analyzed genetic data from 17 studies involving a total of 322 human brain tissue samples and 88 blood samples. Of these, 185 were derived from the dopamine-producing brain cells of deceased patients with Parkinson's. They initially found 28 gene sets to be associated with Parkinson's. Further research looking into the genomes of patients with early Parkinson's narrowed the field to 10 gene sets.

Some of these gene sets contain the genetic code to make proteins involved in the electron transport chain - a set of reactions inside the mitochondria that produce energy.

Defects in the electron transport chain would severely affect the ability of the brain cells to generate energy, the researchers said. It's possible that genetic and environmental influences, along with aging, have a combined impact on the expression of the mitochondrial genes, Scherzer said.

## Future drugs

Medications that activate the PGC-1alpha gene already have been approved by the U.S. Food and Drug Administration for treatment of other diseases, such as diabetes. This means pharmaceutical companies may be able to develop new drugs for Parkinson's by tweaking already developed drugs rather than by starting from scratch, the researchers said.

*The study was funded by the National Institute of Neurological Disorders and Stroke, the National Institute on Aging, and the Michael J. Fox Foundation, among others. This article was provided by MyHealthNewsDaily, a sister site to LiveScience.*

### **First clinical trial of gene therapy for muscular dystrophy lends insight into the disease**

A clinical trial designed to replace the genetic defect causing the most common form of muscular dystrophy has uncovered an unexpected aspect of the disease. The trial, based on therapy designed by scientists at the University of North Carolina at Chapel Hill School of Medicine, showed that some patients mount an immune response to the dystrophin protein even before they have received the gene therapy.

The puzzling results, which came from trials at Columbus Children's Hospital in Ohio, suggest that the immune systems of a number of patients -- once thought to be completely devoid of the dystrophin protein -- are actually primed by the prior existence of tiny amounts of this important component of muscle.

Published this week in the *New England Journal of Medicine*, the study demonstrates how such careful and critical observation in early clinical trials of new therapies can yield new insights into the causes of even the "simplest" single gene disorders.

"These findings are going to be studied intensely going forward, and should help us to understand how to better tailor our treatment approaches to suit the patients' needs," said study author R. Jude Samulski, professor of pharmacology and director of the Gene Therapy Center at UNC.

Duchenne muscular dystrophy is a genetic disease that begins in early childhood, causes progressive muscle weakness, and usually leads to death by the age of twenty from respiratory or cardiac muscle failure. The illness, which primarily affects boys, occurs when a gene on the X chromosome fails to make the essential muscle protein dystrophin. Currently, the best medical therapy can only slow its progression.

The use of gene therapy to correct such single gene disorders has been explored for over two decades and has been met with a number of challenges. In the case of muscular dystrophy, the dystrophin gene is far too large to fit into the typical virus used to carry it into the patient's cells. So collaborator Xiao Xiao, PhD from UNC Eshelman School of Pharmacy engineered a smaller yet functional version of the gene – called a minigene – to place within the viral carrier. His virus of choice was adeno-associated virus or AAV, a small virus that most humans are exposed to at some point in life.

In the first trial of this form of gene therapy, which began in 2006, six boys with muscular dystrophy received the virus containing the dystrophin minigene. A phase I trial, the goals of the study were to assess the efficacy and safety of the new approach. The replacement genes were injected into the bicep in one arm and a placebo was injected into the other arm of each of the patients.

The researchers found that the immune response to the gene varied from patient to patient, perhaps in part because the patients harbored different amounts of "revertant" dystrophin fibers, fibers that have escaped the fate of their mutation. Further studies are needed, but this finding suggests that some patients may benefit from immunosuppression prior to receiving gene therapy.

"We can now use this new information to adapt our approach to make gene therapy more likely to succeed," said Samulski. "Right now we are searching for a way to cure this disease, not just care for it, but truly cure it. So we realize that this effort is going to be an iterative process, with the accumulation of a number of lessons along the way to help us succeed."

One lesson from this study suggests that keeping a close eye on the immune-response profiles of patients could help to enhance the success of not just gene therapy, but also other therapies aimed at restoring dystrophin activity. *Provided by University of North Carolina School of Medicine*

### **Americans' life expectancy continues to fall behind other countries'**

#### **Obesity, smoking, traffic fatalities and homicide ruled out as causes of failure of US to keep up with gains in life expectancy in other countries**

New York, NY The United States continues to lag behind other nations when it comes to gains in life expectancy, and commonly cited causes for our poor performance—obesity, smoking, traffic fatalities, and homicide—are not to blame, according to a Commonwealth Fund-supported study published today as a Health Affairs Web First. The study, by Peter Muennig and Sherry Glied at Columbia University, looked at health spending; behavioral risk factors like obesity and smoking; and 15-year survival rates for men and women ages 45 and 65 in the U.S. and 12 other nations (Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, and the United Kingdom).

While the U.S. has achieved gains in 15-year survival rates decade by decade between 1975 and 2005, the researchers discovered that other countries have experienced even greater gains, leading the U.S. to slip in country ranking, even as per capita health care spending in the U.S. increased at more than twice the rate of the comparison countries. Fifteen-year survival rates for men and women ages 45 and 65 in the US have fallen relative to the other 12 countries over the past 30 years. Forty-five year old U.S. white women fared the worst—by 2005 their 15-year survival rates were lower than that of all the other countries. Moreover, the survival rates of this group in 2005 had not even surpassed the 1975 15-year survival rates for Swiss, Swedish, Dutch or Japanese women. The U.S. ranking for 15-year life expectancy for 45-year-old men also declined, falling from 3rd in 1975 to 12th in 2005, according to the study, "What Changes in Survival Rates Tell Us About U.S. Health Care."

When the researchers compared risk factors among the 13 countries, they found very little difference in smoking habits between the U.S. and the comparison countries—in fact, the U.S. had faster declines in smoking between 1975 and 2005 than almost all of the other countries. In terms of obesity, the researchers found that, while people in the U.S. are more likely to be obese, this was also the case in 1975, when the U.S. was not so far behind in life expectancy. In fact, even as the comparison countries pulled ahead of the US in terms of survival, the percentage of obese men and women actually grew faster in most of those countries between 1975 and 2005. Finally, examining homicide and traffic fatalities, the researchers found that they have accounted for a stable share of U.S. deaths over time, and would not account for the significant change in 15-year life expectancy the study identified.

The researchers say that the failure of the U.S. to make greater gains in survival rates with its greater spending on health care may be attributable to flaws in the overall health care system. They point to the role of unregulated fee-for-service payments and our reliance on specialty care as possible drivers of high spending without commensurate gains in life expectancy.

"It was shocking to see the U.S. falling behind other countries even as costs soared ahead of them," said lead author Peter Muennig, assistant professor at Columbia University's Mailman School of Public Health. "But what really surprised us was that all of the usual suspects—smoking, obesity, traffic accidents, and homicides—are not the culprits. The U.S. doesn't stand out as doing any worse in these areas than any of the other countries we studied, leading us to believe that failings in the U.S. health care system, such as costly specialized and fragmented care, are likely playing a large role in this relatively poor performance on improvements in life expectancy."

"This study provides stark evidence that the U.S. health care system has been failing Americans for years," said Commonwealth Fund President Karen Davis. "It is unacceptable that the U.S. obtains so much less than should be expected from its unusually high spending on health care relative to other countries." The good news is that the Affordable Care Act will take significant steps to improve our health care system and the health of Americans by expanding health insurance, improving primary care, and holding health care organizations accountable for their patients' overall health and ensuring the coordination of primary care and specialty care to eliminate errors, waste of patients' time, and wasteful duplication of tests and services."

*The article is available on the Health Affairs Web site at <http://content.healthaffairs.org/cgi/content/abstract/hlthaff.2010.0073>.*

### **Real price of each pack of cigarettes is more than €100**

Researchers from the Polytechnic University of Cartagena (UPCT) estimate that each pack of cigarettes really costs €107 for men and €75 for women, when premature death is taken into account. These figures confirm previous studies, and are of key importance in the cost-benefit analysis of smoking-prevention policies.

"One of the conclusions of the article is that the price one pays for each pack of cigarettes at a newsstand is only a very small price of the true price that smokers pay for their habit", Ángel López Nicolás, co-author of the study that has been published in the Revista Española de Salud Pública and a researcher at the UPCT, tells SINC. "Given that tobacco consumption raises the risk of death in comparison with non-smokers, it can be assigned a premature death cost for people who do smoke", the researcher explains.

According to the study, the average cost of a pack of cigarettes is not in fact €3-4, but €107 for male smokers and €75 for female smokers.

The study questions the axiom of classic economics on "consumer sovereignty", saying that those who smoke do not do so because the pleasure of smoking is greater than its cost, but rather because of the addictive power of nicotine and their failure to understand its true cost.

In order to determine the mortality cost associated with tobacco consumption in Spain, the experts used the so-called Vale of a Statistical Life (VSL), in other words the amount that people are prepared to pay in order to reduce their risk of death. The VSL estimates the average price to be €2.91 million. "For smokers this is €3.78

million”, López Nicolás explains. “But one must not confuse the cost of premature death with the cost of healthcare. The cost of premature death is borne by the smokers themselves”, López points out.

The team also handled the information on workers in the European Community Household Panel (ECHP) for the 1996-2001 period, and the results of the Ministry of Labour and Immigration Survey on Occupational

### Understanding the costs helps to prevent smoking

“The estimated cost of premature death from a pack of cigarettes is a key element in the cost-benefit analysis of policies designed to prevent and control smoking”, the researchers say.

In this sense, the study indicates that the taxes and smoking restrictions imposed in public places strengthen smokers’ self-control mechanisms. According to the study, “smoking prevention and control policies could generate considerable social benefits, since the wellbeing losses associated with tobacco consumption are much greater than suggested by the external costs”.

“Despite the law on healthcare measures to combat smoking having come into effect in 2006, more can still be done in Spain on measures to control tobacco consumption”, the experts conclude.

<http://www.plataformasinc.es/index.php/esl/Noticias/El-precio-real-de-cada-paquete-de-tabaco-supera-los-100-euros>

## Scientists and Soldiers Solve a Bee Mystery

By KIRK JOHNSON

DENVER — It has been one of the great murder mysteries of the garden: what is killing off the honeybees?

Since 2006, 20 to 40 percent of the bee colonies in the United States alone have suffered “colony collapse.” Suspected culprits ranged from pesticides to genetically modified food. Now, a unique partnership - of military scientists and entomologists - appears to have achieved a major breakthrough: identifying a new suspect, or two.

A fungus tag-teaming with a virus have apparently interacted to cause the problem, according to a paper by Army scientists in Maryland and bee experts in Montana in the online science journal PLoS One.

Exactly how that combination kills bees remains uncertain, the scientists said — a subject for the next round of research. But there are solid clues: both the virus and the fungus proliferate in cool, damp weather, and both do their dirty work in the bee gut, suggesting that insect nutrition is somehow compromised.

Liaisons between the military and academia are nothing new, of course. World War II, perhaps the most profound example, ended in an atomic strike on Japan in 1945 largely on the shoulders of scientist-soldiers in the Manhattan Project. And a group of scientists led by Jerry Bromenshenk of the University of Montana in Missoula has researched bee-related applications for the military in the past — developing, for example, a way to use honeybees in detecting land mines. But researchers on both sides say that colony collapse may be the first time that the defense machinery of the post-Sept. 11 Homeland Security Department and academia have teamed up to address a problem that both sides say they might never have solved on their own.

“Together we could look at things nobody else was looking at,” said Colin Henderson, an associate professor at the University of Montana’s College of Technology and a member of Dr. Bromenshenk’s “Bee Alert” team.

Human nature and bee nature were interconnected in how the puzzle pieces came together. Two brothers helped foster communication across disciplines. A chance meeting and a saved business card proved pivotal. Even learning how to mash dead bees for analysis — a skill not taught at West Point — became a factor.

One perverse twist of colony collapse that has compounded the difficulty of solving it is that the bees do not just die — they fly off in every direction from the hive, then die alone and dispersed. That makes large numbers of bee autopsies — and yes, entomologists actually do those — problematic.

Dr. Bromenshenk’s team at the University of Montana and Montana State University in Bozeman, working with the Army’s Edgewood Chemical Biological Center northeast of Baltimore, said in their jointly written paper that the virus-fungus one-two punch was found in every killed colony the group studied. Neither agent alone seems able to devastate; together, the research suggests, they are 100 percent fatal.

“It’s chicken and egg in a sense — we don’t know which came first,” Dr. Bromenshenk said of the virus-fungus combo — nor is it clear, he added, whether one malady weakens the bees enough to be finished off by the second, or whether they somehow compound the other’s destructive power. “They’re co-factors, that’s all we can say at the moment,” he said. “They’re both present in all these collapsed colonies.”

Research at the University of California, San Francisco, had already identified the fungus as part of the problem. And several RNA-based viruses had been detected as well. But the Army/Montana team, using a new software system developed by the military for analyzing proteins, uncovered a new DNA-based virus, and established a linkage to the fungus, called *N. ceranae*.

“Our mission is to have detection capability to protect the people in the field from anything biological,” said Charles H. Wick, a microbiologist at Edgewood. Bees, Dr. Wick said, proved to be a perfect opportunity to see what the Army’s analytic software tool could do. “We brought it to bear on this bee question, which is how we field-tested it,” he said.

The Army software system — an advance itself in the growing field of protein research, or proteomics — is designed to test and identify biological agents in circumstances where commanders might have no idea what sort of threat they face. The system searches out the unique proteins in a sample, then identifies a virus or other microscopic life form based on the proteins it is known to contain. The power of that idea in military or bee defense is immense, researchers say, in that it allows them to use what they already know to find something they did not even know they were looking for.

But it took a family connection — through David Wick, Charles’s brother — to really connect the dots. When colony collapse became news a few years ago, Mr. Wick, a tech entrepreneur who moved to Montana in the 1990s for the outdoor lifestyle, saw a television interview with Dr. Bromenshenk about bees.

Mr. Wick knew of his brother’s work in Maryland, and remembered meeting Dr. Bromenshenk at a business conference. A retained business card and a telephone call put the Army and the Bee Alert team buzzing around the same blossom.

The first steps were awkward, partly because the Army lab was not used to testing bees, or more specifically, to extracting bee proteins. “I’m guessing it was January 2007, a meeting in Bethesda, we got a bag of bees and just started smashing them on the desk,” Charles Wick said. “It was very complicated.”

The process eventually was refined. A mortar and pestle worked better than the desktop, and a coffee grinder worked best of all for making good bee paste.

Scientists in the project emphasize that their conclusions are not the final word. The pattern, they say, seems clear, but more research is needed to determine, for example, how further outbreaks might be prevented, and how much environmental factors like heat, cold or drought might play a role.

They said that combination attacks in nature, like the virus and fungus involved in bee deaths, are quite common, and that one answer in protecting bee colonies might be to focus on the fungus — controllable with antifungal agents — especially when the virus is detected.

Still unsolved is what makes the bees fly off into the wild yonder at the point of death. One theory, Dr. Bromenshenk said, is that the viral-fungal combination disrupts memory or navigating skills and the bees simply get lost. Another possibility, he said, is a kind of insect insanity.

In any event, the university’s bee operation itself proved vulnerable just last year, when nearly every bee disappeared over the course of the winter.

### **Research identifies the herbal supplements that are effective in treating anxiety**

A systematic review of research into the use of nutritional supplements for the treatment of anxiety disorders has found strong evidence for the use of extracts of passionflower or kava and combinations of L-lysine and L-arginine. Researchers writing in BioMed Central's open access Nutrition Journal pooled the results of 24 studies involving a total of more than 2000 participants, showing that some nutritional and herbal supplements can be effective, without the risk of serious side effects.

The research was carried out by Shaheen Lakhan and Karen Vieira from the Global Neuroscience Initiative Foundation, a non-profit charity organization for the advancement of neurological and mental health patient welfare, education, and research, based in Los Angeles, USA. Lakhan said, "Our review and summary of the literature on herbal remedies and dietary supplements for anxiety should aid mental health practitioners in advising their patients and provide insight for future research in this field. We found mixed results - while passionflower or kava and L-lysine and L-arginine appeared to be effective, St John's Wort and magnesium supplements were not".

Of the studies included in the review, 21 were randomized controlled trials. Of these, 15 showed positive effects from either a nutritional or herbal remedy and any reported side effects were mild to moderate. According to Lakhan, "For all three of the herbal supplements we reviewed, more research needs to be done to establish the most effective dosage and to determine whether this varies between different types of anxiety or anxiety-related disorders. Herbal medicines hold an important place in the history of medicine as most of our current remedies, and the majority of those likely to be discovered in the future, will contain phytochemicals derived from plants".

*More information: Nutritional and herbal supplements for anxiety and anxiety-related disorders: systematic review, Shaheen E Lakhan and Karen F Vieira, Nutrition Journal (in press), <http://www.nutritionj.com/> Provided by BioMed Central*

## New Findings Pull Back Curtain on Relationship Between Iron and Alzheimer's Disease

Massachusetts General Hospital researchers say they have determined how iron contributes to the production of brain-destroying plaques found in Alzheimer's patients.

The team, whose study results appear in the *Journal of Biological Chemistry*, report that there is a very close link between elevated levels of iron in the brain and the enhanced production of the amyloid precursor protein, which in Alzheimer's disease breaks down into a peptide that makes up the destructive plaques.

Dr. Jack T. Rogers, the head of the hospital's neurochemistry lab who oversaw the team's work, said the findings "lay the foundation for the development of new therapies that will slow or stop the negative effects of iron buildup" in patients with the progressive neurodegenerative disease, symptoms of which include memory loss, impaired judgment, disorientation and personality changes.

While it had been known that an abundance of iron in brain cells somehow results in an abundance of amyloid precursor protein, or APP, and its destructive peptide offspring, Rogers' team set out to open up new avenues for therapies by determining what goes on at the molecular level. In 2002, they identified the molecular location where APP and iron interact, a discovery that laid the groundwork for the work being reported now.

Today it is clear that, under healthy conditions, iron and APP keep each other in check: If there's too much iron in a brain cell, more APP is made, and then APP and a partner molecule escort excess iron out. And, as the team reported last month in a related paper in the journal *Cell*, if there's too little iron, fewer APP molecules are made available to help escort iron out. As a result, iron accumulates, and the process begins again in a feedback loop.

Rogers said the team's work detailed in the two recent papers "seals the loop" in what has been understood about APP and iron and paves the way for the development of drugs that will beef up the ability of APP and its partner to eject iron and restore the iron balance when needed.

The researchers also identified, in the *JBC* paper, another important player in the system of checks and balances used to regulate iron in brain cells. Known as IRP1, which stands for iron-regulating protein 1, the special molecule attaches to the messenger RNA that holds the recipe for making APP. When there's less iron in the brain cell, IRP1 is more likely to hook up with the RNA, which prevents the production of APP. When there's abundant iron present, IRP1 doesn't hook up with the RNA, and APP production becomes excessive.

The new information solidified the team's hunch that the particular region where IRP1 binds to the messenger RNA is a potential drug target.

"With other research teams, we are investigating novel therapies that remove excessive iron, and we're looking at the precise spot on the messenger RNA where IRP1 binds to screen for drugs that specifically prevent APP production," said Dr. Catherine Cahill, one of the lead authors.

The team's research was funded by the National Institutes of Health, the Alzheimer's Association and the Institute for the Study of Aging. The resulting "Paper of the Week" will appear in the *JBC*'s Oct. 8 issue. *The other team members were Hyun Hee Cho, Charles R. Vanderburg of Harvard NeuroDiscovery Center, Clemens R. Scherzer of Brigham and Women's Hospital, Bin Wang of Marshall University and Xudong Huang.*

**Editor's Note:** This article is not intended to provide medical advice, diagnosis or treatment.

**Story Source:** The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by American Society for Biochemistry and Molecular Biology, via EurekAlert!, a service of AAAS.

**Journal Reference:**1. H.-H. Cho, C. M. Cahill, C. R. Vanderburg, C. R. Scherzer, B. Wang, X. Huang, J. T. Rogers. Selective Translational Control of the Alzheimer Amyloid Precursor Protein Transcript by Iron Regulatory Protein-1. *Journal of Biological Chemistry*, 2010; 285 (41): 31217 DOI: 10.1074/jbc.M110.149161

## Rare Japanese Plant Has Largest Genome Known to Science

Scientists at Kew's Jodrell Laboratory have discovered that *Paris japonica*, a striking rare native of Japan(1), has the largest genome(2) of them all -- bigger than the human genome and even larger than the previous record holder -- the marbled lungfish.

The results are published in the *Botanical Journal of the Linnean Society*.

The diversity of genome sizes (the amount of DNA) in plants and animals has fascinated but at the same time puzzled scientists since this variation was first detected in the early 20th century. How and why such diversity evolved are important unanswered questions because we know that it has biological and ecological consequences that affect the distribution and persistence of biodiversity.



*Paris japonica*. (Credit: Karl Kristensen, Denmark)



There is a staggering diversity of genome sizes. The smallest genome (3) so far reported (0.0023 pg of DNA) is found in a parasite (*Encephalitozoon intestinalis*) of humans and other mammals. The human genome, at 3.0 pg, is 1300 times larger than this, but this pales into insignificance compared to those found in some animals and plants.

Among animals, some amphibians have enormous genomes, but the largest recorded so far is that of the marbled lung fish (*Protopterus aethiopicus*) with 132.83 pg(3) . Among plants, the record holder for 34 years was a species of fritillary(4) (*Fritillaria assyriaca*) until earlier this year when a Dutch group knocked the fritillary off the top spot when they found that a natural hybrid of trillium (*Trillium × hageae*), related to herb paris had a genome just 4% larger than the fritillary (132.50 pg).

This was widely thought to be approaching the maximum size that a genome could reach, until this summer when a team of Kew scientists discovered that the genome of another close relative of herb paris, *Paris japonica* from Japan, is a staggering 15% bigger than the genome of either the trillium or the fish at a whopping 152.23 pg

Ilia Leitch, Research Scientist in the Jodrell Laboratory, says "We were astounded when we discovered that this small stunning plant had such a large genome -- it's so large that when stretched out it would be taller than Big Ben.

"Some people may wonder what the consequences are of such a large genome and whether it really matters if one organism has more DNA than another. The answer to this is a resounding "yes, it does," and the consequences operate at all levels from the cell up to the whole organism and beyond. In plants, research has demonstrated that those with large genomes are at greater risk of extinction, are less adapted to living in polluted soils and are less able to tolerate extreme environmental conditions -- all highly relevant in today's changing world."

Another example of the significance and importance of genome size in both animals and plants, is the fact that the more DNA there is in a genome, the longer it takes for a cell to copy all its DNA and divide. The knock-on effect of this is that it can take longer for an organism with a larger genome to complete its life cycle than one with a small genome. It is no coincidence that many plants living in deserts which must grow quickly after rains have small genomes enabling them to grow rapidly. In contrast, species with large genomes grow much more slowly and are excluded from such habitats.

Genome size is also positively correlated with nuclear size (the more DNA you have the more space you need for it), and, in many cases, also with cell size which can have knock-on consequences at the whole organism level.

**Notes:**

(1) The group investigated genome size in *Paris japonica* using flow cytometry, comparing it with a range of other plants known to have large genomes.

(2) Genome size is the total amount of DNA in the nucleus of an organism and includes both the genes and the non-coding sequences of the DNA.

(3) Here we are referring to eukaryotes (organisms with membrane enclosed nuclei); viruses and bacteria have even smaller genomes.

(3) This is almost 58,000 times more than the smallest genome in the parasite

(4) The *Fritillaria assyriaca* has a genome with 127.4 pg of DNA This is 55,000 times more than the parasite.

**Story Source:** The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by Royal Botanic Gardens, Kew.

**Journal Reference:** 1. Jaume Pellicer, Michael F. Fay, Ilia J. Leitch. The largest eukaryotic genome of them all? *Botanical Journal of the Linnean Society*, 2010; 164 (1): 10 DOI: 10.1111/j.1095-8339.2010.01072.x

### **New Drug Blocks Morphine's Effects on Breathing -- But Not on Pain**

A new drug called repinotan blocks the respiratory depressant effects of morphine-like opioid drugs -- without altering their potent pain-relieving effects, according to a study in the October issue of *Anesthesia & Analgesia*, official journal of the International Anesthesia Research Society (IARS).

If the promising results of animal studies are borne out by future research, then repinotan could become an important part of safe, effective pain control after surgery. The new study was led by Dr. Ulf Guenther of University of Ulm, Germany.

### **Subcutaneous Oxygen Levels during Surgery Predicts Later Infection Risk**

The researchers performed a series of experiments to see how repinotan influenced the effects of morphine. Although morphine and related drugs (opioids) are highly effective in treating pain after surgery, they share a common characteristic: they decrease the drive to breathe. This is a potentially serious side effect that can limit the use of opioid drugs for pain control.

In the study, rats were given a morphine dose high enough to slow the breathing rate. When the animals were subsequently treated with repinotan, their respiratory rate rapidly returned toward normal.

At the same time, repinotan did not alter the pain-blocking effects of morphine. This is especially important because, although other drugs are available to reverse the respiratory depressant effects of opioids, they also reverse the pain-relieving effects.

There were no serious cardiovascular side effects with repinotan, although it did cause a drop in blood pressure.

"For years, investigators have tried to develop an opioid that produced the profound analgesia of morphine, but without the effects on breathing rate," explains Dr. Steven L. Shafer of Columbia University, Editor-in-Chief of *Anesthesia & Analgesia*. More recently, specific types of drugs have been developed that selectively reverse morphine-induced depression of breathing. Repinotan is the first drug of this type that has proven suitable for studies in humans.

"This is an incredibly exciting development in opioid pharmacology," Dr. Shafer adds. "A drug that blocks the ability of opioids to suppress breathing, while not interfering with the pain relief, would be a huge advance in pain management and patient safety. Unless the drug had other toxicities, such a drug would immediately become the standard of care for post-operative patients receiving opioids."

*Story Source:* The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by International Anesthesia Research Society (IARS), via Newswise.

*Journal Reference:* 1. U. Guenther et al. Repinotan, a Selective 5-HT1A-R-Agonist, Antagonizes Morphine-Induced Ventilatory Depression in Anesthetized Rats. *Anesthesia & Analgesia*, 2010 DOI: 10.1213/00000539-201011000-00011

## **Rare Acne Linked to Alzheimer's**

**By Amber Angelle, MyHealthNewsDaily Contributor**

A study of the genetic mechanism behind acne inversa — a skin disorder that can look similar to other types of acne but shows up only in areas such as the armpit and inner thigh — provides new insight into the development of early-onset familial Alzheimer's disease.

Mutations in a gene, called PSEN1, believed to cause familial Alzheimer's may also cause acne inversa, the researchers said. Interestingly, the scientists found the mutations that cause each disease are distinct, and the two diseases might be mutually exclusive.

Though both Alzheimer's and acne inversa appear to be caused by mutations in PSEN1, there have not been any reported cases of both diseases occurring together, the researchers said. None of the fifty subjects in the new study exhibited symptoms of Alzheimer's disease or dementia.

"We were surprised that PSEN1 mutations caused acne inversa, but got even more excited after realizing" the mutations were in the same gene as the mutations linked to Alzheimer's disease, said study researcher Xue Zhang, of Peking Union Medical College in Beijing. The study, done in China, is published online today (Oct. 7) in the journal *Science*.

### **Finding the link**

The researchers examined the genes of fifty people between the ages of 15 and 81, all from six Chinese families affected by acne inversa over several generations. The researchers found mutations in PSEN1 in these people, but found no such mutations in the 200 people they also tested who did not have the acne condition.

PSEN1 had previously been linked to the development of early-onset Alzheimer's — scientists have found more than 160 mutations in PSEN1. The mutations affect a protein called gamma-secretase, which is involved in the build-up of protein plaques in the brains of people with Alzheimer's disease.

Although future studies would need to confirm Zhang's findings, the results hint at the possibility that people with acne inversa are somehow protected from early-onset Alzheimer's disease.

"It's an interesting question, but so far we have no answer," Zhang said.

### **Treatments for both conditions**

In any case, Zhang said, just as the protein gamma-secretase has been a target for developing drugs to treat Alzheimer's disease, it may also be a good target for acne inversa treatments. And because different mutations in PSEN1 cause both diseases, the drugs may in fact work more effectively for acne inversa patients.

So far, drugs targeting gamma-secretase have not performed well in Alzheimer's patients in clinical trials. For example, Eli Lilly's drug semagacestat (also called LY450139), perhaps the most promising of these drugs, performed so poorly the company halted Phase 3 clinical trials of the drug in August.

In early studies, the drug reduced brain plaques, but in the larger, Phase 3 studies, semagacestat "was associated with worsening of clinical measures of cognition," according to a statement from Eli Lilly and Company.

Zhang's study indicates the type of PSEN1 mutation involved may lead to very different diseases.

"Skin might be more sensitive to changes in gamma-secretase activity," Zhang told My Health News Daily, "and the mutations associated with Alzheimer's disease might have a distinct pathogenic mechanism."

Some researchers have said instead of targeting gamma-secretase itself, Alzheimer's drugs should target proteins that affect its activity. Last month, researchers reported in the journal *Nature* an average 38 percent reduction of Alzheimer's plaques in the brains of mice treated with an inhibitor of a protein that activates gamma secretase. Blocking the activity of its activator may be better way to target this protein, the researchers said.

Such treatments could also reduce side effects, because gamma-secretase regulates other pathways important for normal cell function. "There are many unanswered questions," Zhang said. "We don't know why mutations in the gamma-secretase genes cause these different diseases."

Next, Zhang plans to research other genes that may cause different forms of acne inversa.

### **New Strong-Handed Dinosaur May Shatter Assumptions Were gentle, plant-eating giants also scavengers and opportunists?**

**Brian Handwerk** for National Geographic News

Fossils of an intriguing new species with a powerful hand may reveal an edgier side of some supposedly peaceful, plant-munching dinosaurs, a new study says.

The discovery of *Sarahsaurus aurifontanalis*, which roamed North America about 190 million years ago, also boosts the idea that at least some dinosaurs became masters of their domain less by dominance than by opportunistic behavior and a bit of good luck.

A remarkably complete *Sarahsaurus* skeleton, found in Arizona, shows that the early Jurassic herbivore was, at 14 feet (4.3 meters) long and 250 pounds (113 kilograms), smaller than its enormous sauropod cousins such as *Apatosaurus*, which arose later.



*Sarahsaurus aurifontanalis* in an artist's rendering. Illustration courtesy John Maisano

Like the sauropods—the largest animals to walk Earth—*Sarahsaurus* featured a long neck and small head. But the newly identified creature also boasted strong teeth and an unusual clawed hand, that, while only human size, was clearly built for enormous power and leverage, according to paleontologists.

"The dogma is that these animals were herbivores, but these hands and massive claws reopen the door to what they might have been doing with them," said study leader Tim Rowe, a paleontologist at the University of Texas. "Looking at the teeth, I think they could have eaten anything that they wanted, so they may have also been scavengers and not pure herbivores."

#### **Mass Extinction Prompted Dinosaur Migration?**

Beyond its bizarre appearance, the new species lends support to the relatively new view that dinosaurs came to dominate North America by being opportunistic, not necessarily by overpowering their competitors.

Dinosaurs, including *Sarahsaurus*, are generally believed to have originated in South America—then part of the ancient southern supercontinent Pangaea. But how and why they conquered the rest of the world is a matter of more debate.

By dating bones of *Sarahsaurus* and two other previously described species, scientists suggest that sauropod ancestors migrated to North America in several waves after the Triassic-Jurassic mass extinction killed off the dinosaurs' North American competition 200 million years ago.

"It's not as if they stormed the beaches," Rowe noted.

"They had to wait for this natural catastrophe to empty the neighborhood. So they were opportunists, not completely superior invaders. The poignant story to me is that of recovery after a great extinction."

The *Sarahsaurus* skeleton also spurred a reanalysis of existing fossil fragments in other species, Rowe said.

For instance, the team now asserts that sauropods were completely absent in North America prior to the Triassic-Jurassic extinction that wiped out more than half of the planet's species. (See a prehistoric time line.)

#### ***Sarahsaurus* Fills "Black Hole"**

Utah Museum of Natural History paleontologist Mark Loewen, who was not involved in the research, agrees that the study provides more evidence for a later sauropodomorph dispersal into North America. Parts of the theory aren't entirely new, but the new evidence is consistent with what others have said, he added.

Loewen also said *Sarahsaurus* is a very important species, helping to fill out a family tree that has been quite bare in its particular time and place. "We don't have any real well-known sauropodomorphs from that

formation," he said. "It's basically been a black hole of knowledge in the American West, a place where we know so much about dinosaurs.

"I think this will change how we look at the dispersal of [sauropod ancestors] and how they evolved over time."

### **Dinosaur Luck Ran Out?**

Study co-author Hans-Dieter Sues said "it's just strange that we find lots of [sauropod ancestors earlier] in Europe, South Africa, South America, and even in Greenland, but in [North America's] Triassic, even with a fantastic fossil record, not a single bone or tooth has been found."

"There must have been something that excluded these guys," said Sues, a curator of vertebrate paleontology at the National Museum of Natural History in Washington, D.C.

"In the past, it's been argued that dinosaurs had superior adaptations to other reptiles, but it seems to be more a case of opportunism"—when competitive species were wiped out, he added.

If the Triassic-Jurassic extinction was beneficial to dinosaurs, the beasts got their own comeuppance 135 million years later.

"For reasons that we don't understand, dinosaurs survived that [Triassic-Jurassic] extinction event without any apparent casualties while a lot of other groups went extinct," said Sues, whose study appeared October 6 in the online edition of Proceedings of the Royal Society B. "That's interesting, because 65 million years ago, it was the dinosaurs' turn to go extinct, and only one [dinosaur] group, the birds, survived."

### **Animals Said to Have Spiritual Experiences**

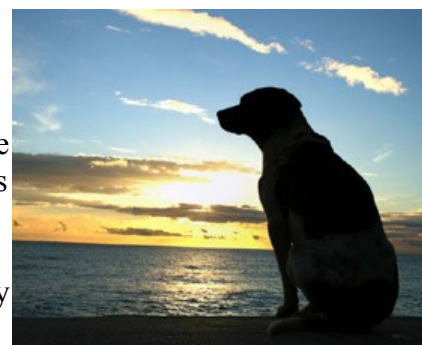
***Ever have an out-of-body experience? Your dog may have too.***

**By Jennifer Viegas | Fri Oct 8, 2010 07:00 AM ET**

Animals (not just people) likely have spiritual experiences, according to a prominent neurologist who has analyzed the processes of spiritual sensation for over three decades.

Research suggests that spiritual experiences originate deep within primitive areas of the human brain -- areas shared by other animals with brain structures like our own. The trick, of course, lies in proving animals' experiences.

"Since only humans are capable of language that can communicate the richness of spiritual experience, it is unlikely we will ever know with certainty what an animal subjectively experiences," Kevin Nelson, a professor of neurology at the University of Kentucky, told Discovery News.



***Spiritual experiences originate within primitive parts of the human brain, structures shared by animals, like dogs.***

iStockPhoto

"Despite this limitation, it is still reasonable to conclude that since the most primitive areas of our brain happen to be the spiritual, then we can expect that animals are also capable of spiritual experiences," added Nelson, author of the book "The Spiritual Doorway in the Brain," which will be published in January 2011.

The finding is an extension of his research on humans, which has been published in many peer-reviewed journals. A Neurology journal study, for example, determined that out-of-body experiences in humans are likely caused by the brain's arousal system, which regulates different states of consciousness.

"In humans, we know that if we disrupt the (brain) region where vision, sense of motion, orientation in the Earth's gravitational field, and knowing the position of our body all come together, then out-of-body experiences can be caused literally by the flip of a switch," he said. "There is absolutely no reason to believe it is any different for a dog, cat, or primate's brain."

Other mammals also probably have near-death experiences comparable to those reported by certain humans, he believes. Such people often say they saw a light and felt as though they were moving down a tunnel.

The tunnel phenomenon "is caused by the eye's susceptibility to the low blood flow that occurs with fainting or cardiac arrest," he said. "As blood flow diminishes, vision fails peripherally first. There is no reason to believe that other animals are any different from us."

Nelson added, "What they make of the tunnel is another matter."

The light aspect of near-death experiences can be explained by how the visual system defines REM (rapid eye movement) consciousness, he believes.

"In fact," he said, "the link between REM and the physiological crises causing near-death experience are most strongly linked in animals, like cats and rats, which we can study in the laboratory."

Mystical experiences -- moments that inspire a sense of mystery and wonderment -- arise within the limbic system, he said. When specific parts of this system are removed from animal brains, mind-altering drugs like LSD have no effect.

Since other animals, such as non-human primates, horses, cats and dogs, also possess similar brain structures, it is possible that they too experience mystical moments, and may even have a sense of spiritual oneness, according to Nelson.

Marc Bekoff, a professor emeritus of ecology and evolutionary biology at the University of Colorado, Boulder, also believes animals have spiritual experiences, which he defines as experiences that are nonmaterial, intangible, introspective and comparable to what humans have.

Both he and primatologist Jane Goodall have observed chimpanzees dancing with total abandon at waterfalls that emerge after heavy rains. Some of the chimps even appear to dance themselves into a trance-like state, as some humans do during religious and cultural rituals.

Goodall wondered, "Is it not possible that these (chimpanzee) performances are stimulated by feelings akin to wonder and awe? After a waterfall display the performer may sit on a rock, his eyes following the falling water. What is it, this water?"

"Perhaps numerous animals engage in these rituals, but we haven't been lucky enough to see them," Bekoff wrote in a Psychology Today report.

"For now, let's keep the door open to the idea that animals can be spiritual beings and let's consider the evidence for such a claim," he added.

"Meager as it is, available evidence says, 'Yes, animals can have spiritual experiences,' and we need to conduct further research and engage in interdisciplinary discussions before we say that animals cannot and do not experience spirituality."

### **Ancient tattoos linked to healing ritual**

\* 13:01 08 October 2010 by Jo Marchant

Mysterious circle tattoos on a Peruvian mummy have been identified as containing burned plant material. The finding sheds light on a possible ancient healing practice that may have been based on similar principles to acupuncture.

The 1000-year-old female mummy was found unwrapped in the sand of the desert at Chiribaya Alta in southern Peru in the early 1990s. She bears two distinct types of tattoos: emblems representing birds, apes, reptiles and other symbols cover her hands, arm and lower left leg, while an asymmetric pattern of overlapping circles is present on her neck.

Maria Anna Pabst of the Medical University of Graz in Austria and her colleagues used microscopy and spectroscopy to analyse the tattoos. Almost all known ancient tattoos were made with ash or soot. But the researchers found that while this was true for the tattoos on this mummy's extremities, the circles on her neck contained burned plant material.

Pabst says this is strong evidence that the two sets of tattoos were made with different intentions. "If you use different materials, they have different functions," she says. The team believe that while the soot tattoos were decorative, the neck circles were probably part of a healing or strengthening ritual.

#### **Acupuncture similarities**

Pabst points out that the circles are close to Chinese acupuncture points. She says that tattooing a person at these points could have worked in a similar way to how acupuncture is thought to work. The plants chosen as the staining material would presumably have had medicinal properties, she adds.

From the location of the circles, Pabst concludes that the tattoo treatment may have been intended to relax the subject or to relieve neck pain. When she showed a drawing of the tattoos to a modern-day shamanic healer in Peru, he suggested that they might have been part of a strengthening ritual on an upper-class subject.

The idea that some ancient tattoos have a therapeutic purpose has been suggested before. For example, 5300-year-old Ötzi the Iceman, the oldest European mummy, has some tattooed lines and crosses on his back and legs, which appear to be close to acupuncture points (The Lancet, vol 354, p 1023). But Pabst's study is the first to compare the two types of tattoo in the same mummy.

*Journal reference: Journal of Archaeological Science, DOI: 10.1016/j.jas.2010.07.026*

### **Plants kick-start evolutionary drama of Earth's oxygenation**

TEMPE, Az. - An international team of scientists, exploiting pioneering techniques at Arizona State University, has taken a significant step toward unlocking the secrets of oxygenation of the Earth's oceans and atmosphere.

Evolution of the Earth's multitude of organisms is intimately linked to the rise of oxygen in the oceans and atmosphere. The new research indicates that the appearance of large predatory fish as well as vascular plants approximately 400 million years ago coincided with an increase in oxygen, to levels comparable to those we experience today. If so, then animals from before that time appeared and evolved under markedly lower oxygen conditions than previously thought.

The researchers, including collaborators from Harvard, Denmark, Sweden and the United Kingdom, made use of a method developed at ASU by Ariel Anbar, a professor in the department of chemistry and biochemistry and the School of Earth and Space Exploration in the College of Liberal Arts and Sciences, and his research group. The method can be used to estimate global oxygen levels in ancient oceans from the chemical composition of ancient seafloor sediments.

Their important findings are presented in a paper published in this week's online Early Edition of the Proceedings of the National Academy of Sciences (PNAS), titled "Devonian rise in atmospheric oxygen correlated to radiations of terrestrial plants and large predatory fish."

"There has been a lot of speculation over the years about whether or not oxygen in the atmosphere was steady or variable over the last 500 million years," explained Anbar, who leads ASU's Astrobiology Program. "This is the era during which animals and land plants emerged and flourished. So it's a profound question in understanding the history of life. These new findings not only suggest that oxygen levels varied, but also that the variation had direct consequences for the evolution of complex life."

The Earth is 4,500 million years old. Microbial life has probably thrived in the oceans for most of that time. However, until about 2,300 million years ago, the atmosphere contained only traces of oxygen. During that time, some microbes in the oceans likely produced oxygen as a byproduct of photosynthesis. But the quantities they produced were insufficient to accumulate much in the atmosphere and oceans. The situation changed with the "Great Oxidation Event", 2,300 million years ago. Oxygen levels rose again around 550 million years ago. The first animals appear in the fossil record at this time, marking the beginning of an era that geologists call the "Phanerozoic" – a Greek word meaning "evident animals". This new work explores how oxygen levels changed during the Phanerozoic.

The new study was led by Tais W. Dahl while he was a postdoctoral scholar at Harvard. Dahl spent several months in Anbar's lab at ASU during his graduate research learning how to make the necessary measurements from Gwyneth Gordon, Ph.D., who is also an author of this paper. Other authors include geochemist Don Canfield, Dahl's Ph.D. mentor at the University of Southern Denmark, and paleontologist Andrew Knoll, Dahl's postdoctoral mentor at Harvard.

Dahl returned to ASU to perform the measurements for this study, which involved measuring the relative amounts of different isotopes of the element molybdenum in rocks called "black shales". These rocks are formed from ancient ocean sediments.

Isotopes are atoms of an element, in this case molybdenum, that differ only in their mass and therefore can be easily distinguished from one another. Molybdenum has seven stable isotopes. Chemical reactions fractionate heavy from light isotopes. For example, carbon 12 is enriched by three percent in plants relative to the carbon in carbon dioxide in the atmosphere. Similarly, molybdenum isotopes are fractionated during their removal from seawater into ocean sediments. The magnitude of this fractionation is sensitive to the presence of oxygen.

The data Dahl obtained at ASU reveal that there were at least two stages of oxygenation during the Phanerozoic, separated by the oxygenation event 400 million years ago. This inference from molybdenum isotopes is corroborated by the appearance of large (up to 30 feet long) predatory fish in the fossil record 400 million years ago, coincident with the rise in oxygen. Animals of that size consume energy rapidly, requiring high levels of oxygen for their metabolism. "Tais's data indicate that early animals evolved in an environment with less oxygen than today," said Anbar. The newly discovered oxygenation event therefore explains the puzzling appearance of these fish in the fossil record. "It's always satisfying when we can demonstrate how an environmental change drove biological evolution," Anbar explained.

"But the real kicker is that these data also show us the reverse - that biological innovation can drive environmental change" continued Anbar. He points to the fact that vascular plants also appear in the fossil record around 400 million years ago. The bodies of such plants decompose with difficulty, making it easier for organic carbon to be buried in sediments. When that happens, the organic carbon - produced by photosynthesis - is not available for reaction with oxygen. The consequence is a rise in the amount of oxygen in the environment.

"It's a push-me-pull-you situation," explained Anbar. The biological innovation of vascular plants led to more carbon burial, and therefore to more oxygen. Then, the rise in oxygen made it possible for larger animals to evolve. "This is a great example of what we call the "co evolution" of life and the environment", enthused Anbar "Geoscientists talk about this idea a lot, but we rarely find such nice examples."

*This work was supported by the Danish National Research Foundation, Danish Council for Independent Research, the Swedish Research Council, the NASA Astrobiology Institute team at ASU and the NASA Exobiology Program.*

## New Class of Highly Electronegative Chemical Species Discovered

An international team of researchers has discovered a new class of highly electronegative chemical species called hyperhalogens, which use superhalogens as building blocks around a metal atom. The new chemical species may have application in many industries.

Researchers from Virginia Commonwealth University, McNeese State University in Lake Charles, La., and the University of Konstanz in Germany report their discovery in the Oct. 6 international chemistry journal *Angewandte Chemie International Edition*. The journal designated the paper as "very important," recognition granted to only 5 percent of papers it receives.

Chlorine is one of the elements called halogens, a group that includes fluorine, bromine, and iodine. These chemicals are known for their disinfecting and deodorizing power and are also used in some medications and industrial processes. Researchers say that hyperhalogens could be useful in industries where large amounts of halogens are now needed to make cleaning or decontamination products.

Chemists and physicists like Puru Jena, Ph.D., distinguished professor of physics at VCU, know halogens for their reactivity, a characteristic that makes the halogen elements want to bond with another element or a compound by taking one electron. Chlorine, for example, likes being paired with sodium to make table salt. Sodium wants to give away an electron and chlorine wants to take that electron in what Jena calls "a perfect marriage."

"Halogens only need one electron to reach their happy state," said Jena. "They're much more stable as a negative ion than as a neutral atom." Once the atom takes an electron and becomes a stable, negative ion, the energy it gains is measured by its electron affinity. In chemistry's periodic table, chlorine has the highest electron affinity, measured at 3.6 electron volts, or eV. One area of Jena's research focuses on finding ways to make new classes of compounds with large electron affinities.

In 1962, English chemist Neil Bartlett found that platinum hexafluoride reacts with xenon to make a noble gas compound. Scientists were surprised because xenon was one of the stable or "noble" gases that rarely react with other elements. A dozen years later, two Soviet scientists, Gennady Gutsev and Alexander Boldyrev, showed that a larger class of molecules with a metal atom at the center surrounded by halogen atoms, similar to platinum hexafluoride, possesses electron affinities larger than that of chlorine. They termed these molecules "superhalogens."

"For example, you could take a sodium atom and a chlorine atom to make a sodium chloride molecule and then attach a second chlorine atom. That compound would then want another electron because of the extra chlorine," Jena said. "All of a sudden, the electron affinity, which is the characteristic we're after, becomes almost a factor of two larger than that of the chlorine atom. It becomes a superhalogen."

Superhalogens have similar, improved properties as halogens, Jena said.

Jena, together with Anil Kandalam, Ph.D., assistant professor at McNeese State University, theorized that they could push the electron affinity of a cluster or a molecule even higher, by using superhalogens as building blocks, instead of halogens, around a metal atom. The theoretical model was tested through experimental studies led by Gerd F. Ganteför, Ph.D., at the University of Konstanz. They termed these species with unusually large electron affinities as "hyperhalogens."

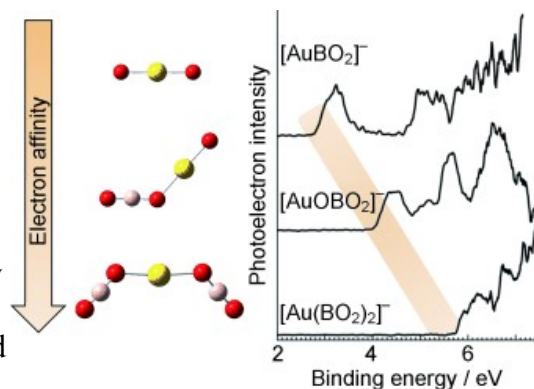
"We used gold as the metal and surrounded it with two boron-dioxide superhalogens and got a hyperhalogen with an even greater electron affinity," Jena said.

The team's synergistic approach involving theory and experiment produced a gold-borate hyperhalogen with an electron affinity of 5.7 eV. The team now is testing a hyperhalogen constructed with four boron-dioxide superhalogens and have reached an electron affinity of 7 eV, with a goal of building a hyperhalogen with 10 eV. These new hyperhalogens may lead to additional discoveries of novel chemicals, Jena said.

The theoretical investigations for the project were conducted by Jena and graduate student Mary Willis at VCU, along with Kandalam. The experimental work was conducted by Ganteför and graduate student Matthias Götz at the University of Konstanz.

*The work was supported in part by the federal Defense Threat Reduction Agency and the Department of Energy.*

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



### **UT Southwestern researchers create experimental vaccine against Alzheimer's**

DALLAS – Researchers at UT Southwestern Medical Center have created an experimental vaccine against beta-amyloid, the small protein that forms plaques in the brain and is believed to contribute to the development of Alzheimer's disease.

Compared with similar so-called DNA vaccines that the UT Southwestern researchers tested in an animal study, the new experimental vaccine stimulated more than 10 times as many antibodies that bind to and eliminate beta-amyloid. The results appeared in the journal *Vaccine*. Future studies will focus on determining the safety of the vaccine and whether it protects mental function in animals, said Dr. Roger Rosenberg, director of the Alzheimer's Disease Center at UT Southwestern and senior author of the study.

"The antibody is specific; it binds to plaque in the brain. It doesn't bind to brain tissue that does not contain plaque," Dr. Rosenberg said. "This approach shows promise in generating enough antibodies to be useful clinically in treating patients."

A traditional vaccine – an injection of beta-amyloid protein itself into the arm – has been shown in other research to trigger an immune response, including the production of antibodies and other bodily defenses against beta-amyloid. However, the immune response to this type of vaccine sometimes caused significant brain swelling, so Dr. Rosenberg and his colleagues focused on developing a nontraditional DNA vaccine.

The DNA vaccine does not contain beta-amyloid itself but instead a piece of the beta-amyloid gene that codes for the protein. In the current study, the researchers coated tiny gold beads with the beta-amyloid DNA and injected them into the skin of the animals' ears. Once in the body, the DNA stimulated an immune response, including antibodies to beta-amyloid.

The next step in the research is to test long-term safety in animals, Dr. Rosenberg said.

"After seven years developing this vaccine, we are hopeful it will not show any significant toxicity, and that we will be able to develop it for human use," he said.

*Other UT Southwestern neurology researchers involved in the study were Dr. Bao-Xi Qu, assistant professor; Dr. Doris Lambracht-Washington, research scientist; Min Fu, research associate; Dr. Todd Eagar, assistant professor; and Dr. Olaf Stüve, associate professor.*

*The study was funded by the National Institutes of Health, The Rudman Foundation and the Alzheimer's Association.*

### **Yersinia pestis bacteria clearly identified as the cause of the big plague epidemic of the Middle Ages**

The latest tests conducted by anthropologists at the Johannes Gutenberg University Mainz (JGU) have proven that the bacteria *Yersinia pestis* was indeed the causative agent behind the "Black Death" that raged across Europe in the Middle Ages. The cause of the epidemic has always remained highly controversial and other pathogens were often named as possible causes, in particular for the northern European regions. Using DNA and protein analyses from skeletons of plague victims, an international team led by the scientists from Mainz has now conclusively shown that *Yersinia pestis* was responsible for the Black Death in the 14th century and the subsequent epidemics that continued to erupt throughout the European continent for the next 400 years. The tests conducted on genetic material from mass graves in five countries also identified at least two previously unknown types of *Yersinia pestis* that occurred as pathogens. "Our findings indicate that the plague traveled to Europe over at least two channels, which then went their own individual ways," explains Dr Barbara Bramanti from the Institute of Anthropology of Mainz University. The works, published in the open access journal *PLoS Pathogens*, now provide the necessary basis for conducting a detailed historical reconstruction of how this illness spread.

For a number of years, Barbara Bramanti has been researching major epidemics that were rampant throughout Europe and their possible selective consequences as part of a project funded by the German Research Foundation (DFG). For the recently published work, 76 human skeletons were examined from suspected mass graves for plague victims in England, France, Germany, Italy, and the Netherlands. While other infections such as leprosy can be easily identified long after death by the deformed bones, the problem faced in the search for plague victims lies in the fact that the illness can lead to death within just a few days and leaves no visible traces. With luck, DNA of the pathogen may still be present for many years in the dental pulp or traces of proteins in the bones. Even then it is difficult to detect, and may be distorted through possible contamination. The team led by Bramanti found their results by analyzing old genetic material, also known as ancient DNA (aDNA): Ten specimens from France, England, and the Netherlands showed a *Yersinia pestis*-specific gene. Because the samples from Parma, Italy and Augsburg, Germany gave no results, they were



subjected to another method known as immunochromatography (similar to the method used in home pregnancy tests for example), this time with success.

Once the infection with *Yersinia pestis* had been conclusively proven, Stephanie Hänsch and Barbara Bramanti used an analysis of around 20 markers to test if one of the known bacteria types "orientalis" or "medievalis" was present. But neither of these two types was found. Instead, two unknown forms were identified, which are older and differ from the modern pathogens found in Africa, America, the Middle East, and the former Soviet Union regions. One of these two types, which are thought to have contributed significantly to the catastrophic course of the plague in the 14th century, most probably no longer exists today. The other appears to have similarities with types that were recently isolated in Asia.

In their reconstruction, Hänsch and Bramanti show an infection path that runs from the initial transportation of the pathogen from Asia to Marseille in November 1347, through western France to northern France and over to England. Because a different type of *Yersinia pestis* was found in Bergen op Zoom in the Netherlands, the two scientists believe that the South of the Netherlands was not directly infected from England or France, but rather from the North. This would indicate another infection route, which ran from Norway via Friesland and down to the Netherlands. Further investigations are required to uncover the complete route of the epidemic. "The history of this pandemic," stated Hänsch, "is much more complicated than we had previously thought."

<http://www.uni-mainz.de/eng/13883.php>

### **Drug firm welcomes Alzheimer's boost**

***Plans to treat more patients in the early stages of Alzheimer's disease with drugs could have a "huge impact" on the Welsh economy, it is claimed.***

The Alzeim firm, from Talgarth near Brecon, Powys, farms daffodils for a compound called galantamine, which slows the progress of the disease. It is doubling the land used to 120 acres (48ha), but said thousands more acres were needed to meet world demand.

The medicine watchdog said drugs could lessen disease symptoms early on. This reverses earlier rulings that the drugs did not offer sufficient benefit to justify the cost in Wales and England.



***Galantamine is extracted from daffodils and turned into crystals***

The three drugs which look likely to be available to patients with "mild" Alzheimer's are Aricept (donepezil), Reminyl (galantamine) and Exelon (rivastigmine).

In addition, the National Institute for Health and Clinical Excellence (NICE) said a fourth drug, Ebixa, should be prescribed to patients with more advanced Alzheimer's.

Following the decision, Alzeim is planting a further 60 acres (24ha) in the Black Mountains near Talgarth, and will open a production line at new offices in Brecon in a fortnight.

#### **'Huge boost'**

Company spokesman Kevin Stephens said world demand for galantamine was "absolutely huge".

"This could have a huge impact on the Welsh economy and give it a huge boost," he said. "We anticipated NICE would have to reverse its decision, so we're doubling our acreage to 120 acres and we are building a production line. "We could have 4,000 acres, but it wouldn't meet the demand for this product."

Mr Stephens said farmers now had the opportunity to diversify and grow daffodils to help meet the demand in a global market for Alzheimer's drugs worth some £8bn.

The firm currently employs eight people, but there are no plans to increase staff at the moment.

Until now, galantamine has been extracted from snowdrops grown in Bulgaria and China. It is already available in Scotland, but it has to be prescribed privately elsewhere as it is not on NICE's prescription list.

Alzeim's daffodils are grown on the slopes of the Black Mountains after trials showed that the location produced blooms with greater concentrations of galantamine than those grown in lower areas.

In 2008, the company received £850,000 from the Welsh Assembly Government's investment company Finance Wales and private investors to go into commercial production of the drug.

Company chairman Sir Roger Jones said at the time that the business could expand into other areas of Wales if necessary.

There are about 40,000 people in Wales suffering from Alzheimer's and 700,000 in Britain.

Rebecca Wood, chief executive of the Alzheimer's Research Trust, welcomed NICE's plans.

She said: "These drugs hold the promise of relief from the symptoms of Alzheimer's for thousands of people and, while not the cure we desperately need, they can still help."

## Largest stone age settlement found near Chennai

**D Madhavan**, TNN, Sep 25, 2010, 12.03am IST

SINGADIVAKKAM (KANCHEEPURAM): In what could be a major find, a large number of stone tools and weapons said dating back to more than 80,000 years ago were unearthed from a dry lake bed in Singadivakkam, a remote hamlet some 65 km south of Chennai, a couple of days ago.

The discovery, by Professor S Rama Krishna Pisipaty and his student S Shanmugavelu of the department of Sanskrit and culture at Sri Chandrasekaharendra Saraswathi Viswa Mahavidyalaya in Enathur, Kancheepuram, was part of an ongoing excavation work partly funded by the Archaeological Survey of India (ASI).

They have so far found hand-axes, choppers, scrappers and borers as well as microlithic tools (small stone implements) and pointed tools of different sizes and shapes. Most could have been used for hunting and fishing, they said.

The huge number of tools found, said to be over 200, at the one-hectare-site indicates that it could have hosted a large human settlement, Prof Pisipaty said. Most of the settlers may have migrated from the northern parts of the country, he added. "The settlement, as can be gauged from the tools found, shows transition from early to middle Paleolithic age, also known as the Stone Age," Prof Pisipaty noted.

This period, the geo-archeologist added, encompassed the first widespread use of technology as humans progressed from simple to complex development stages. It is generally said to have begun approximately 500,000 years ago and ended about 6,000 BCE with the development of agriculture, the domestication of certain animals and the smelting of copper ore, he said. It is termed pre-historic since writing hadn't begun. In the early Paleolithic period, each clan or family group regarded itself as "the people" and excluded others, Prof Pisipaty said. Strangers were not even thought of as human. In this settlement, the community identity started becoming more important than individual identity, he said.

Unlike other similar finds, including the first Paleolithic tool (a hand axe) discovered at Pallavaram in 1863 by British geo-archeologist Robert Bruce Foote, the one at Singadivakkam is, Prof Pisipaty said, unique at least for one reason: The site has evidence in the form of tools and weapons showing the transition from the Stone Age to the modern age. In the rest of the Paleolithic sites discovered so far, he added, there had been a break in the sequence. This makes it the largest Paleolithic settlement near Chennai, he said.

The professor and his student also discovered fossil remains of animals and trees at the site. "There are a few research institutes in the country, including IIT Madras, where they can be tested for age and we plan to send them there," Prof Pisipaty said.

Professor Pisipaty and Shanmugavelu, who had been conducting excavations at the site since February 2009, began with basic research, including field visits. A large number of pebbles in different forms and the nature of soil convinced them of the importance of the area. Before starting the exercise, Pisipaty made a presentation to the authorities and got permission through the state archeological department. "Kancheepuram was ideal for early settlers with its large number of safe water bodies a lifeline for any human settlement," Pisipaty, who did his doctoral thesis at Benaras University in Lucknow, told TOI.

## Butterflies Cure Themselves with Plants

**By Jennifer Viegas** | Fri Oct 8, 2010 04:04 PM ET

Monarch butterflies can cure themselves and their offspring of disease by using medicinal plants, according to a new paper in the journal Ecology Letters.

The disease is caused by a protozoan parasite called *Ophryocystis elektroscirrha*. The parasite invades the gut of the caterpillars and then persists when the caterpillars become adult monarchs.

Project leader Jaap de Roode in eScience Commons today said, "We have shown that some species of milkweed, the larva's food plants, can reduce parasite infection in the monarchs. And we have also found that infected female butterflies prefer to lay their eggs on plants that will make their offspring less sick, suggesting that monarchs have evolved the ability to medicate their offspring."

De Roode, assistant professor of biology at Emory University, said, "'We believe that our experiments provide the best evidence to date that animals use medication.'"

At Discovery News, we've touched on the topic before for other species. Spider monkeys, for example, are



*Monarch caterpillar* *Adult monarch butterfly*  
( Jaap de Roode and Lisa Sharling)

thought to have discovered a medicated body scratcher. But there are relatively few such studies on self-medication by animals.

In this case, there's added interest because the behavior is enacted by a creature that, despite its beauty, is fairly low on the food chain. Plus, the behavior is trans-generational, says Thierry Lefevre, a post-doctoral fellow in de Roode's lab. "While the mother is expressing the behavior, only her offspring benefit."

Health-related decisions made by non-human species could also potentially benefit us in future. For example, researchers like chemical ecologist Mark Hunter have been studying milkweed plants to determine their medicinal properties.

### **Study reveals cancer-linked epigenetic effects of smoking**

For the first time, UK scientists have reported direct evidence that taking up smoking results in epigenetic changes associated with the development of cancer.

The results were reported at the 35th Congress of the European Society for Medical Oncology (ESMO) in Milan, Italy.

The link between smoking and cancer has been established for decades, explained Dr Yuk Ting Ma from the Cancer Research UK Institute of Cancer Studies, Birmingham, who presented the results. Smoking is the single biggest cause of cancer in the world, and years of research have confirmed that carcinogenic substances in tobacco smoke can damage DNA.

Scientists have also suspected that smoking causes so-called epigenetic changes, such as methylation, which alter gene expression without causing changes to the actual DNA sequence.

"Until now, however, there has been no direct evidence that smoking induces DNA methylation in humans," Dr Ma said. "Cross-sectional surveys restricted to patients with cancer have revealed that aberrant methylation of several tumor suppressor genes is associated with smoking. But such surveys cannot distinguish those epigenetic changes that are a consequence of the disease process from those which are directly attributable to smoking."

In a study funded by Cancer Research UK, the British team set out to clarify the link between smoking and methylation in a cohort of 2,011 healthy young women aged 15-19 who were originally recruited as part of a study of pre-cancerous changes to cells of the cervix.

"For this particular study we have identified all the women from that cohort who had normal smears and who also tested negative for human papillomavirus throughout follow-up," Dr Ma explained. "In this subgroup of disease-free women we have then tested the cervical smears of all the women who first started to smoke following study entry for p16 methylation, and compared them to women who were never smokers."

The researchers selected this group of women to ensure there were no potential confounding factors for the detection of p16 methylation in otherwise healthy young women.

The particular gene the researchers were studying was p16, a so-called tumor suppressor gene. When it is methylated, this gene's normal tumor-suppressing function is inactivated.

"DNA methylation is a type of epigenetic change that can result in tumor suppressor genes being inactivated," said Dr Ma. "Methylation of p16 has been frequently associated with the development of cancer in many parts of the body."

Because the women were all taking part in a study of cervical neoplasia, Dr Ma used cells from cervical smears to test for methylation of p16. Her group found that women who took up smoking during the study were more than three times as likely (odds ratio of 3.67) to acquire p16 methylation.

"Our study showed that compared with never-smokers, women who first started to smoke during follow-up had an increased risk of acquiring methylation of p16," Dr Ma said. "Our choice of study design and our study population allowed us to reveal, for the first time, the relationship between starting to smoke and the subsequent appearance of an epigenetic change."

The results provide evidence that smoking does induce DNA methylation, Dr Ma said. "The next step is now to show that women who acquire such smoking-induced methylation have an increased risk of developing malignancy."

### **Google Cars Drive Themselves, in Traffic**

**By JOHN MARKOFF**

MOUNTAIN VIEW, Calif. — Anyone driving the twists of Highway 1 between San Francisco and Los Angeles recently may have glimpsed a Toyota Prius with a curious funnel-like cylinder on the roof. Harder to notice was that the person at the wheel was not actually driving.

The car is a project of Google, which has been working in secret but in plain view on vehicles that can drive themselves, using artificial-intelligence software that can sense anything near the car and mimic the decisions made by a human driver.

With someone behind the wheel to take control if something goes awry and a technician in the passenger seat to monitor the navigation system, seven test cars have driven 1,000 miles without human intervention and more than 140,000 miles with only occasional human control. One even drove itself down Lombard Street in San Francisco, one of the steepest and curviest streets in the nation. The only accident, engineers said, was when one Google car was rear-ended while stopped at a traffic light.

Autonomous cars are years from mass production, but technologists who have long dreamed of them believe that they can transform society as profoundly as the Internet has.

Robot drivers react faster than humans, have 360-degree perception and do not get distracted, sleepy or intoxicated, the engineers argue. They speak in terms of lives saved and injuries avoided — more than 37,000 people died in car accidents in the United States in 2008. The engineers say the technology could double the capacity of roads by allowing cars to drive more safely while closer together. Because the robot cars would eventually be less likely to crash, they could be built lighter, reducing fuel consumption. But of course, to be truly safer, the cars must be far more reliable than, say, today's personal computers, which crash on occasion and are frequently infected.

The Google research program using artificial intelligence to revolutionize the automobile is proof that the company's ambitions reach beyond the search engine business. The program is also a departure from the mainstream of innovation in Silicon Valley, which has veered toward social networks and Hollywood-style digital media.

During a half-hour drive beginning on Google's campus 35 miles south of San Francisco last Wednesday, a Prius equipped with a variety of sensors and following a route programmed into the GPS navigation system nimbly accelerated in the entrance lane and merged into fast-moving traffic on Highway 101, the freeway through Silicon Valley.

It drove at the speed limit, which it knew because the limit for every road is included in its database, and left the freeway several exits later. The device atop the car produced a detailed map of the environment.

The car then drove in city traffic through Mountain View, stopping for lights and stop signs, as well as making announcements like "approaching a crosswalk" (to warn the human at the wheel) or "turn ahead" in a pleasant female voice. This same pleasant voice would, engineers said, alert the driver if a master control system detected anything amiss with the various sensors.

The car can be programmed for different driving personalities — from cautious, in which it is more likely to yield to another car, to aggressive, where it is more likely to go first.

Christopher Urmson, a Carnegie Mellon University robotics scientist, was behind the wheel but not using it. To gain control of the car he has to do one of three things: hit a red button near his right hand, touch the brake or turn the steering wheel. He did so twice, once when a bicyclist ran a red light and again when a car in front stopped and began to back into a parking space. But the car seemed likely to have prevented an accident itself.

When he returned to automated "cruise" mode, the car gave a little "whir" meant to evoke going into warp drive on "Star Trek," and Dr. Urmson was able to rest his hands by his sides or gesticulate when talking to a passenger in the back seat. He said the cars did attract attention, but people seem to think they are just the next generation of the Street View cars that Google uses to take photographs and collect data for its maps.

The project is the brainchild of Sebastian Thrun, the 43-year-old director of the Stanford Artificial Intelligence Laboratory, a Google engineer and the co-inventor of the Street View mapping service.

In 2005, he led a team of Stanford students and faculty members in designing the Stanley robot car, winning the second Grand Challenge of the Defense Advanced Research Projects Agency, a \$2 million Pentagon prize for driving autonomously over 132 miles in the desert.

Besides the team of 15 engineers working on the current project, Google hired more than a dozen people, each with a spotless driving record, to sit in the driver's seat, paying \$15 an hour or more. Google is using six Priuses and an Audi TT in the project.

The Google researchers said the company did not yet have a clear plan to create a business from the experiments. Dr. Thrun is known as a passionate promoter of the potential to use robotic vehicles to make highways safer and lower the nation's energy costs. It is a commitment shared by Larry Page, Google's co-founder, according to several people familiar with the project.

The self-driving car initiative is an example of Google's willingness to gamble on technology that may not pay off for years, Dr. Thrun said. Even the most optimistic predictions put the deployment of the technology more than eight years away.

One way Google might be able to profit is to provide information and navigation services for makers of autonomous vehicles. Or, it might sell or give away the navigation technology itself, much as it offers its Android smart phone system to cellphone companies.

But the advent of autonomous vehicles poses thorny legal issues, the Google researchers acknowledged. Under current law, a human must be in control of a car at all times, but what does that mean if the human is not really paying attention as the car crosses through, say, a school zone, figuring that the robot is driving more safely than he would?

And in the event of an accident, who would be liable — the person behind the wheel or the maker of the software?

“The technology is ahead of the law in many areas,” said Bernard Lu, senior staff counsel for the California Department of Motor Vehicles. “If you look at the vehicle code, there are dozens of laws pertaining to the driver of a vehicle, and they all presume to have a human being operating the vehicle.”

The Google researchers said they had carefully examined California’s motor vehicle regulations and determined that because a human driver can override any error, the experimental cars are legal. Mr. Lu agreed.

Scientists and engineers have been designing autonomous vehicles since the mid-1960s, but crucial innovation happened in 2004 when the Pentagon’s research arm began its Grand Challenge.

The first contest ended in failure, but in 2005, Dr. Thrun’s Stanford team built the car that won a race with a rival vehicle built by a team from Carnegie Mellon University. Less than two years later, another event proved that autonomous vehicles could drive safely in urban settings.

Advances have been so encouraging that Dr. Thrun sounds like an evangelist when he speaks of robot cars. There is their potential to reduce fuel consumption by eliminating heavy-footed stop-and-go drivers and, given the reduced possibility of accidents, to ultimately build more lightweight vehicles.

There is even the farther-off prospect of cars that do not need anyone behind the wheel. That would allow the cars to be summoned electronically, so that people could share them. Fewer cars would then be needed, reducing the need for parking spaces, which consume valuable land.

And, of course, the cars could save humans from themselves. “Can we text twice as much while driving, without the guilt?” Dr. Thrun said in a recent talk. “Yes, we can, if only cars will drive themselves.”

### **Progress toward first commercial repellent for East Coast's stinker**

Help may be on the way for millions of people on the East Coast bugged out about the invasion of stink bugs. Scientists have reported a key advance in efforts to develop the first commercial repellent for stinkbugs, which are emerging as a major nuisance to homeowners and a devastating pest to some farm crops. They identified a natural substance in a fungus that infects a common weed and found that it shows potential as the first stinkbug repellent. Their study appeared in ACS' Journal of Agricultural and Food Chemistry.



*Brown Marmorated Stink Bug*

Hiromitsu Nakajima and colleagues note that stinkbugs are no strangers to Japan. Indeed, they long have ranked as major pests of rice crops there and in some other countries. In contrast, the brown marmorated stinkbug seems to have gotten a foothold in the United States around 1998, and since then has spread, especially in the Mid-Atlantic states, invading homes and damaging fruit and vegetable crops. The nuisance bugs get their name from the skunk-like odor they emit when crushed or annoyed.

Farmers are trying to control the pests using a variety of commercial insecticides, which kill the bugs. A stinkbug repellent could be just as effective in keeping the bugs at bay, but no reports on development of such materials have appeared in scientific journals, they say.

The scientists isolated a fungus from the green foxtail plant, a common weed found in Japan as well as the United States and other countries. The fungus lives inside the plant and appears to help protect the foxtail from insect pests and disease. In laboratory tests, extracts of the fungus strongly repelled the white-spotted stinkbug, which they used as a test subject because it is easy to collect, maintain, and handle under laboratory conditions.

The scientists identified an ingredient in the extract that is capable of repelling up to 90 percent of stinkbugs and suggest that this chemical could be part of the first repellent for controlling stinkbugs. The substance repelled the stinkbugs as effectively as naphthalene, an ingredient in mothballs and a gold-standard for measuring the effects of insect repellents. A chemically modified version of the substance was almost twice as effective as naphthalene.

*More information: "3-(4-Methylfuran-3-yl)propan-1-ol: A White-Spotted Stinkbug (Eysarcoris ventralis) Repellent Produced by an Endophyte Isolated from Green Foxtail", Journal of Agricultural and Food Chemistry.*

## New Bacterial Foe in Cystic Fibrosis Identified

Exacerbations in cystic fibrosis (CF) may be linked to chronic infection with a bacterium called *Stenotrophomonas maltophilia*, which was previously thought to simply colonize the CF lung. The finding that chronic infection with *S. maltophilia* is independently linked with an increased risk of exacerbations gives clinicians and researchers a new potential measure of the health status of CF patients, as well as a new potential target in fighting their disease.

The findings were published online ahead of the print edition of the American Thoracic Society's *American Journal of Respiratory and Critical Care Medicine*.

"Our study showed that chronic infection with *S. maltophilia*, which was previously not regarded as prognostically significant, may have a real impact on the progression of CF in patients," said Valerie Waters, M.D., assistant professor of infectious diseases at the Hospital for Sick Children in Toronto. "We hope that this study is a starting point for further research, which may point to therapeutic possibilities associated with controlling these infections."

CF is a congenital disease that is characterized by thick, sticky mucus in the lungs and digestive tract, leading to chronic infections and shortened life. Over time, exacerbations in CF can lead to permanent loss of lung function, thus driving the progression of this deadly disease. About one in 31,000 people are born with CF, and there is no cure, although new treatments have dramatically improved and extended the lives of CF patients in recent decades. At present, the average lifespan of a CF patient is 35 years.

As CF patients are living longer than ever before, respiratory tract colonization and infection with multi-drug resistant pathogens are increasing in frequency. Among these, *S. maltophilia* is particularly common and is isolated from the respiratory tract of up to a third of CF patients. To assess whether *S. maltophilia* represented a true infection, rather than merely a colonizing organism, and whether it had an impact on the progression of disease, Dr. Waters and colleagues performed a two-stage study. In the first stage, they sought to determine if *S. maltophilia* generated an immune response in CF patients. In the second stage, they retrospectively followed almost 700 CF patients for 12 years to determine whether chronic infection with *S. maltophilia* was independently associated with an increased risk of exacerbation or lowered lung function.

They found that antibody levels to *S. maltophilia* flagellin, were about two times higher in chronically infected patients compared to those who were never infected, indicating a specific immune response and a true infection, rather than mere colonization. The increased antibody levels were also associated with lower lung function, as measured by FEV1 (forced expiratory volume in one second.)

Furthermore, they found that patients with chronic *S. maltophilia* infections had a 63 percent greater risk of exacerbations than those who had never been infected, although there were no significant differences detected in the rate of lung function decline.

"This is the first study to our knowledge that demonstrates CF patients with chronic *S. maltophilia* infection have a specific immune response, which is in turn associated with lower lung function," said Dr. Waters. "There have been few studies that investigate the effect of *S. maltophilia* infection on clinical outcomes; those that have been short-term and have not shown any significant clinical effects of the infection. This study, however, points to the possibility that chronic infection has a real and significant clinical impact on these patients."

While the length of the study may not have been sufficient to determine any possible differences in lung function between chronically infected CF patients and those who were intermittently or never infected, Dr. Waters points out that these effects may in fact occur, possibly in younger patients.

"It is crucial that we look to determine whether chronic *S. maltophilia* infection directly results in the worsening of lung function," she said. "We plan to investigate the effects of chronic *S. maltophilia* during pulmonary exacerbations in future studies."

*Editor's Note: This article is not intended to provide medical advice, diagnosis or treatment.*

**Story Source:** *The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by American Thoracic Society, via EurekAlert!, a service of AAAS.*

**Journal Reference:** *I. V. Waters, Y. Yau, S. Prasad, A. Lu, E. Atenafu, I. Crandall, S. Tom, E. Tullis, F. Ratjen. Stenotrophomonas Maltophilia in Cystic Fibrosis: Serologic Response and Effect on Lung Disease. American Journal of Respiratory and Critical Care Medicine, 2010; DOI: 10.1164/rccm.201009-1392OC*

## Land 'evapotranspiration' taking unexpected turn: huge parts of world are drying up

CORVALLIS, Ore. – The soils in large areas of the Southern Hemisphere, including major portions of Australia, Africa and South America, have been drying up in the past decade, a group of researchers conclude in the first major study to ever examine "evapotranspiration" on a global basis.

Most climate models have suggested that evapotranspiration, which is the movement of water from the land to the atmosphere, would increase with global warming. The new research, published online this week in the journal *Nature*, found that's exactly what was happening from 1982 to the late 1990s.

But in 1998, this significant increase in evapotranspiration – which had been seven millimeters per year – slowed dramatically or stopped. In large portions of the world, soils are now becoming drier than they used to be, releasing less water and offsetting some moisture increases elsewhere.

Due to the limited number of decades for which data are available, scientists say they can't be sure whether this is a natural variability or part of a longer-lasting global change. But one possibility is that on a global level, a limit to the acceleration of the hydrological cycle on land has already been reached.

If that's the case, the consequences could be serious.

They could include reduced terrestrial vegetation growth, less carbon absorption, a loss of the natural cooling mechanism provided by evapotranspiration, more heating of the land surface, more intense heat waves and a "feedback loop" that could intensify global warming.

"This is the first time we've ever been able to compile observations such as this for a global analysis," said Beverly Law, a professor of global change forest science at Oregon State University. Law is co-author of the study and science director of the AmeriFlux network of 100 research sites, which is one major part of the FLUXNET synthesis that incorporates data from around the world.

"We didn't expect to see this shift in evapotranspiration over such a large area of the Southern Hemisphere," Law said. "It is critical to continue such long-term observations, because until we monitor this for a longer period of time, we can't be sure why this is occurring."

Some of the areas with the most severe drying include southeast Africa, much of Australia, central India, large parts of South America, and some of Indonesia. Most of these regions are historically dry, but some are actually tropical rain forests.

The rather abrupt change from increased global evapotranspiration to a near halt in this process coincided with a major El Niño event in 1998, the researchers note in their report, but they are not suggesting that is a causative mechanism for a phenomenon that has been going on for more than a decade now. Greater evapotranspiration was expected with global warming, because of increased evaporation of water from the ocean and more precipitation overall. And data indeed show that some areas are wetter than they used to be.

However, other huge areas are now drying out, the study showed. This could lead to increased drought stress on vegetation and less overall productivity, Law said, and as a result less carbon absorbed, less cooling through evapotranspiration, and more frequent or extreme heat waves.

Some of the sites used in this study are operated by Law's research group in the central Oregon Cascade Range in the Metolius River watershed, and they are consistent with some of these concerns. In the last decade there have been multiple years of drought, vegetative stress, and some significant forest fires in that area.

Evapotranspiration returns about 60 percent of annual precipitation back to the atmosphere, in the process using more than half of the solar energy absorbed by land surfaces. This is a key component of the global climate system, linking the cycling of water with energy and carbon cycles.

Longer term observations will be needed to determine if these changes are part of decadal-scale variability or a longer-term shift in global climate, the researchers said.

*This study was authored by a large group of international scientists, including from OSU; lead author Martin Jung from the Max Planck Institute for Biogeochemistry in Germany; and researchers from the Institute for Atmospheric and Climate Science in Switzerland, Princeton University, the National Center for Atmospheric Research in Colorado, Harvard University, and other groups and agencies.*

*The regional networks, such as AmeriFlux, CarboEurope, and the FLUXNET synthesis effort, have been supported by numerous funding agencies around the world, including the Department of Energy, NASA, National Science Foundation, and National Oceanic and Atmospheric Administration in the United States.*

**Editor's Note:** *The study citation is: Jung, M., M. Reichstein, P. Ciais, S.I. Seneviratne, J. Sheffield, M.L. Goulden, G. Bonan, A. Cescatti, J. Chen, R. de Jeu, A.J. Dolman, W. Eugster, D. Gerten, D. Gianelle, N. Gobron, J. Heinke, J. Kimball, B.E. Law, L. Montagnani, Q. Mu, B. Mueller, K. Oleson, D. Papale, A.D. Richardson, O. Roupsard, S.W. Running, E. Tomelleri, N. Viovy, U. Weber, C. Williams, E. Wood, S. Zaehle, K. Zhang. 2010. A recent decline in the global land evapotranspiration trend due to limited moisture supply. *Nature* xxx: xxx-xxx. DOI 10.1038/nature09396.*