

New life histories emerge for invasive wasps, magnify ecological harm

A switch from annual to multiyear colonies and a willingness to feed just about any prey to their young have allowed invasive yellowjacket wasps to disrupt native populations of insects and spiders on two Hawaiian islands, a new study has found.

By analyzing the DNA from bits of prey snatched from foragers returning to nests, ecologists from the University of California, San Diego, found that introduced yellowjacket wasps kill or scavenge prey from 14 different taxonomic orders of animals, even reptiles and birds.

"They're consuming anything from geckos to shearwater to tree lice to more juicy items that you would expect them to eat, like caterpillars. They're just like little vacuum cleaners," said Erin Wilson, who recently completed her doctorate at UC San Diego and is the lead author of the study reported in the Proceedings of the National Academy of Sciences this week.



Yellowjackets Erin Wilson

Wilson and her colleagues found that nearby populations of caterpillars and spiders rebounded when rangers removed wasp nests.

Existing traits, like a flexible diet, can explain why some transplanted species become invasive, but the way a new environment might alter the invader's behavior is seldom considered, the authors say.

In their native range, Western yellowjackets (*Vespula pensylvanica*) nearly always form nests in the spring that become dormant before winter. In Hawaii's mild climate, however, up to 20 percent of colonies persist for years, grow to enormous sizes and have become major pests. One colony on Maui had as many as 600,000 individuals, compared to the usual size of a few thousand wasps.

"Rather than having a nest the size of a football, you'll have a nest the size of a '57 Buick," Wilson said. "Our largest colony had four nest entrances that were just like fire hoses of wasps coming in and out." More than three times as many foragers return to perennial nests each minute compared to annual nests, the researchers found, most of them bringing food.

The sheer numbers are changing the ecology of Hawaii's endangered ohia woodlands and subalpine shrublands. "It's not just what they're killing," Wilson said. "They're also collecting great amounts of nectar, drawing down the resources for anything else that might want to feed on it whether it's native insects or birds like the Hawaiian honeycreepers."

In the fall of 2006 and 2007 Wilson traveled to Hawaii Volcanoes National Park on the island of Hawaii and Haleakala National Park on Maui to study the wasps.

Adult wasps mostly consume nectar, but collect protein-rich food for their developing larvae and carry it back to the nest. Wilson and her field assistants plucked bits of food from the mandibles of 500 foragers returning to 10 different nests, five in each park, then sequenced the DNA.

"We were able to identify, using genetics, very small prey items," Wilson said. They compared the sequences to a public database and to sequences they obtained from whole, identifiable specimens collected near the nests to create a comprehensive catalogue of the wasps' diet.

Although wasps will scavenge food from carcasses, more than two-thirds of the confiscated food bits were from freshly killed prey, they found, including native spiders, flies, crickets, bark lice, and *Hylaeus* bees.



Yellowjackets Erin Wilson

The wasps also eat other introduced insects, which are abundant in Hawaii, such as European honeybees. These fellow invaders may help to sustain larger populations of wasps than the native fauna could, the authors say.

When park officials removed colonies, nearby populations of native spiders and caterpillars rebounded. With the yellowjackets gone, spiders increased by 36% and caterpillars increased by 86% they found.

"We were not only seeing what the yellowjackets consumed, we were actually able to tie that directly to predation," Wilson said. "We were able to say these things in the diet are actually being depressed at the population level."

Co-authors include biology professor David Holway and Lynne Mullen, a former graduate student at UC San Diego, who now studies at Harvard University. The National Science foundation and the Environmental Protection agency funded the work.

Clotting in veins close to skin may be associated with more dangerous deep-vein blood clots

About one-fourth of patients with superficial vein thrombosis - clotting in blood vessels close to the skin - also may have the life-threatening condition deep vein thrombosis, according to a report in the July issue of Archives of Dermatology, one of the JAMA/Archives journals.

"Superficial vein thrombosis is a common disease that most often affects the veins of the leg but can also be found in other locations," the authors write as background information in the article. Different risk factors have been reported, many of which are the same as risk factors for deep vein thrombosis - varicose veins, thrombophilia (a disorder in which the blood clots too easily), use of oral contraceptives, trauma, malignancy or a period of immobility. "In the past, not much interest has been focused on superficial vein thrombosis because of its generally benign course. However, recent investigations showed an unsuspected association of superficial vein thrombosis with deep vein thrombosis and thromboembolism [blockage of a blood vessel by a clot that has broken apart]."

Barbara Binder, M.D., of the Medical University of Graz, Austria, and colleagues studied 46 consecutive patients (32 women and 14 men) with superficial vein thrombosis between November 2006 and June 2007. All patients underwent color-coded duplex sonography, an imaging test, to confirm superficial vein thrombosis and exclude or detect deep vein thrombosis. Participants also reported their history of clotting events, use of oral contraceptives and compression stockings, any recent immobilization and active malignant disease. Laboratory tests included D-dimer levels, a measure of protein fragments that tends to be elevated in patients with deep vein thrombosis.

Deep vein thrombosis was detected in 24 percent of patients with superficial vein thrombosis and was usually asymptomatic. Deep vein thrombosis occurred in the same leg as superficial vein thrombosis in 73 percent of the patients, in the other leg in 9 percent and in both legs in 18 percent. "The calf muscle veins were most commonly involved," the authors write. "In all patients with deep vein thrombosis, the superficial vein thrombosis was located on the lower leg and the D-dimer findings were positive."

"Generally, superficial vein thrombosis is regarded as a condition with an uncomplicated course and usually is not considered to be a severe or life-threatening disease. However, the occurrence of concomitant deep vein thrombosis and/or pulmonary embolism [blood clot that travels to the lungs] may lead to severe complications," they continue. "The results of this study indicate that concurrent deep vein thrombosis is more likely when superficial vein thrombosis affects the lower leg. In these cases, the deep veins should be assessed by color-coded duplex sonography (from the inguinal [groin] region to the ankle) to exclude or confirm acute deep vein thrombosis." (*Arch Dermatol.* 2009;145[7]:753-757. Available pre-embargo to the media at www.jamamedia.org.)

California's Channel Islands hold evidence of Clovis-age comets

University of Oregon-led research team digs up strongest evidence yet for a controversial cosmic event

A 17-member team has found what may be the smoking gun of a much-debated proposal that a cosmic impact about 12,900 years ago ripped through North America and drove multiple species into extinction.

In a paper appearing online ahead of regular publication in the Proceedings of the National Academy of Sciences, University of Oregon archaeologist Douglas J. Kennett and colleagues from nine institutions and three private research companies report the presence of shock-synthesized hexagonal diamonds in 12,900-year-old sediments on the Northern Channel Islands off the southern California coast.



This map shows California's Channel Islands with the islands of the previously combined islands of Santarosae encircled at the top. Courtesy NOAA and UC Santa Barbara

These tiny diamonds and diamond clusters were buried deeply below four meters of sediment. They date to the end of Clovis -- a Paleoindian culture long thought to be North America's first human inhabitants. The nano-sized diamonds were pulled from Arlington Canyon on the island of Santa Rosa that had once been joined with three other Northern Channel Islands in a landmass known as Santarosae.

The diamonds were found in association with soot, which forms in extremely hot fires, and they suggest associated regional wildfires, based on nearby environmental records.

Such soot and diamonds are rare in the geological record. They were found in sediment dating to massive asteroid impacts 65 million years ago in a layer widely known as the K-T Boundary. The thin layer of iridium-

and-quartz-rich sediment dates to the transition of the Cretaceous and Tertiary periods, which mark the end of the Mesozoic Era and the beginning of the Cenozoic Era.

"The type of diamond we have found - Lonsdaleite - is a shock-synthesized mineral defined by its hexagonal crystalline structure. It forms under very high temperatures and pressures consistent with a cosmic impact," Kennett said. "These diamonds have only been found thus far in meteorites and impact craters on Earth and appear to be the strongest indicator yet of a significant cosmic impact [during Clovis]."

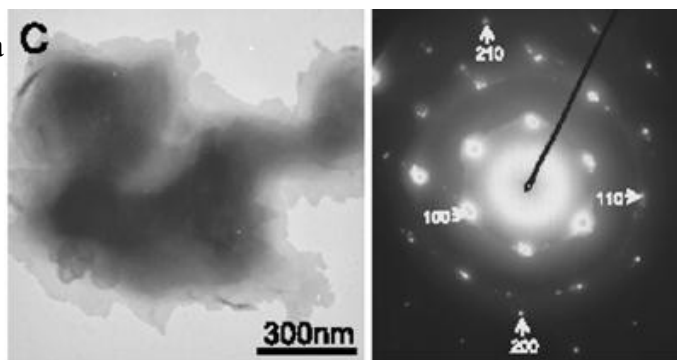
The age of this event also matches the extinction of the pygmy mammoth on the Northern Channel Islands, as well as numerous other North American mammals, including the horse, which Europeans later reintroduced. In all, an estimated 35 mammal and 19 bird genera became extinct near the end of the Pleistocene with some of them occurring very close in time to the proposed cosmic impact, first reported in October 2007 in PNAS.

In the Jan. 2, 2009, issue of the journal *Science*, a team led by Kennett reported the discovery of billions of nanometer-sized diamonds concentrated in sediments - weighing from about 10 to 2,700 parts per billion - in six North American locations.

"This site, this layer with hexagonal diamonds, is also associated with other types of diamonds and with dramatic environmental changes and wildfires," said James Kennett, paleoceanographer and professor emeritus in the Department of Earth Science at the University of California, Santa Barbara.

"There was a major event 12,900 years ago," he said. "It is hard to explain this assemblage of materials without a cosmic impact event and associated extensive wildfires. This hypothesis fits with the abrupt cooling of the atmosphere as shown in the record of ocean drilling of the Santa Barbara Channel. The cooling resulted when dust from the high-pressure, high-temperature, multiple impacts was lofted into the atmosphere, causing a dramatic drop in solar radiation."

The hexagonal diamonds from Arlington Canyon were analyzed at the UO's Lorry I. Lokey Laboratories, a world-class nanotechnology facility built deep in bedrock to allow for sensitive microscopy and other high-tech analyses of materials. The analyses were done in collaboration with FEI, a Hillsboro, Ore., company that distributes the high-resolution Titan microscope used to characterize the hexagonal diamonds in this study.



This transmission electron microscopy close-up shows a single lonsdaleite crystal, left, and associated diffraction pattern. University of Oregon

Transmission electron microscopy and scanning electron microscopes were used in the extensive analyses of the sediment that contained clusters of Lonsdaleite ranging in size from 20 to 1,800 nanometers. These diamonds were inside or attached to carbon particles found in the sediments.

These findings are inconsistent with the alternative and already hotly debated theory that overhunting by Clovis people led to the rapid extinction of large mammals at the end of the ice age, the research team argues in the PNAS paper. An alternative theory has held that climate change was to blame for these mass extinctions. The cosmic-event theory suggests that rapid climate change at this time was possibly triggered by a series of small and widely dispersed comet strikes across much of North America.

The National Science Foundation provided primary funding for the research. Additional funding was provided by way of Richard A. Bray and Philip H. Knight faculty fellowships of the University of Oregon, respectively, to Kennett and UO colleague Jon M. Erlandson, a co-author and director of the UO's Museum of Natural and Cultural History.

The 17 co-authors on the PNAS paper are Douglas Kennett, Erlandson and Brendan J. Culleton, all of the University of Oregon; James P. Kennett of UC Santa Barbara; Allen West of GeoScience Consulting in Arizona; G. James West of the University of California, Davis; Ted E. Bunch and James H. Wittke, both of Northern Arizona University; Shane S. Que Hee of the University of California, Los Angeles; John R. Johnson of the Santa Barbara Museum of Natural History; Chris Mercer of the Santa Barbara Museum of Natural History and National Institute of Materials Science in Japan; Feng Shen of the FEI Co.; Thomas W. Stafford of Stafford Research Inc. of Colorado; Adrienne Stich and Wendy S. Wolbach, both of DePaul University in Chicago; and James C. Weaver of the University of California, Riverside.

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Young men living at home with parents are more violent

Young men who stay at home with their parents are more violent than those who live independently, according to new research at Queen Mary, University of London.

The new study* indicates that men still living at home in their early twenties have fewer responsibilities and more disposable income to spend on alcohol.

This group makes up only four percent of the UK's male population but they are responsible for 16 per cent of all violent injuries in the last five years. Delaying social independence and remaining in the parental home have become more common over the past 40 years in both the UK and the USA.

Professor Jeremy Coid and Dr Ming Yang surveyed over 8000 men and women. Participants answered questions about violent behaviour over the past 5 years and mental health problems. Their results showed for the first time that staying in the parental home is a stronger risk factor for young men's violence than any other factor.

Professor Coid said: "Young adult men living at home in Britain are no longer influenced by parents to conform to standards of behaviour expected of previous generations. Violence outside of the home, mainly involving strangers, is the most common scenario and just one of a series of hedonistic and negative social behaviours such as hazardous drinking, drug misuse, sexual risk taking, and non-violent antisocial behaviour.

"And these are more common among young men who do not have responsibilities of providing their own accommodation, supporting dependent children, or experiencing beneficial effects on their behaviour from living with a female partner.

"Young men who live at home are also more likely to receive financial support from their parents than in the past when the pattern was reversed. However, in this study their earnings or benefits were the same as those who had left home and taken on greater social responsibility. They therefore had more disposable income which may have partly explained why they had more problems with alcohol."

**Violence and Delayed Social Independence Among Young Adult British Men, Jeremy Coid and Min Yan g. Social Psychiatry and Psychiatric Epidemiology.*

Venus flytrap origins uncovered

Matt Walker Editor, Earth News

The origin of the voracious Venus flytrap has been uncovered.

The flytrap, and one other carnivorous snap-trap plant which grows underwater, evolved from a more conventional relative that had sticky leaves.

Over time, the plants added elaborate structures and weapons such as trigger hairs and teeth to trap and immobilise their meaty prey, botanists say. Ultimately, the need to hunt and eat ever larger animals drove the plants' evolution, say the scientists.

Carnivorous plants come in many forms, and are known to have independently evolved at least six separate times. For example, pitcher plants create tube-like leaf structures into which insects tumble and become trapped, while other plants have sticky surfaces that act like flypaper.



But among all these plants, two species stand out: the Venus flytrap (*Dionaea muscipula*) and the waterwheel plant (*Aldrovanda vesiculosa*). Both are known as snap-traps because they actively hunt animals, snapping shut specially adapted leaves to trap any hapless creature that crosses them.

The Venus flytrap closes around an insect in just 0.3s or faster, while the waterwheel use thin translucent traps to snare copepods and other aquatic invertebrates.

Charles Darwin was so enamoured by this striking adaptation, and the speed with which it works, that he described the Venus flytrap as being "one of the most wonderful plants in the world."

"Darwin was fascinated by carnivorous plants in general and the Venus flytrap in particular, I think, partly because they go against type," says Don Waller, a botanist at the University of Wisconsin, in Madison, US.

"In his time and ours, most of us feel that plants are passive, harmless, and can't move. But the Venus flytrap acts like an animal, it moves fast and eats fresh meat."

Elusive origins

But until now, it has not been clear which plant the Venus flytrap and waterwheel evolved from.

Waller and his colleague Thomas Gibson now think they have the answer, which they have published in the journal *New Phytologist*. What is more, they think its possible to trace a series of steps that the Venus flytrap and waterwheel must have undergone to become accomplished hunters.

They started by comparing snap-traps with other carnivorous plants known as sticky traps.

The two types look very different. While snap traps have gaping leaves, sticky traps have small leaves that are covered by simple stalks, which are often covered in sticky glue.

Many sticky trap plants belong to the genus *Drosera* , such as the circumboreal sundew (*Drosera rotundifolia*), and come in various forms.

A DNA analysis by Ken Cameron of the University of Wisconsin confirmed that the Venus flytrap and waterwheel are indeed related, and the closest relative of both turns out to be a species called *Drosera regia*.

Then Waller and Gibson mapped out the steps that would have been required to evolve from a sticky trap ancestor into a snap-trap.

First the ancestral plant must have adapted to move its tentacles and leaves in a particular direction, giving it a greater chance of sticking to and engulfing a passing insect. Next it sped up how quickly it detected prey and tried to respond.

Then the plant would have had to find a way to become selective, so it only tried to trap live prey and not any detritus that landed upon it.

Finally, it must have evolved its tentacles into sensory hairs and teeth that detect and wrap around prey, respectively, while also losing its sticky glands and growing new digestive glands capable of digesting the victim's corpse.

But that raises the question of what strong selection pressure could have driven the evolution of such an extraordinary series of adaptations?

Bigger and better

The short answer, say Waller and Gibson, is the benefits of eating ever larger prey.

"Capturing big prey provides big rewards to any carnivorous plant, and snap-traps can immobilize and digest these bigger prey far more effectively than the sticky fly-paper type traps we see in sundews," says Waller.

"A bug twice as long as another has more like eight times the biomass and nutrients, so these rewards accelerate as prey get bigger. This is why flytraps build bigger traps as soon as they can, unlike almost all other plants where the size of leaves or traps remains the same as plants get bigger."

Waller also suspects that engulfing and sealing in prey may also provide other advantages to the Venus flytrap and waterwheel.

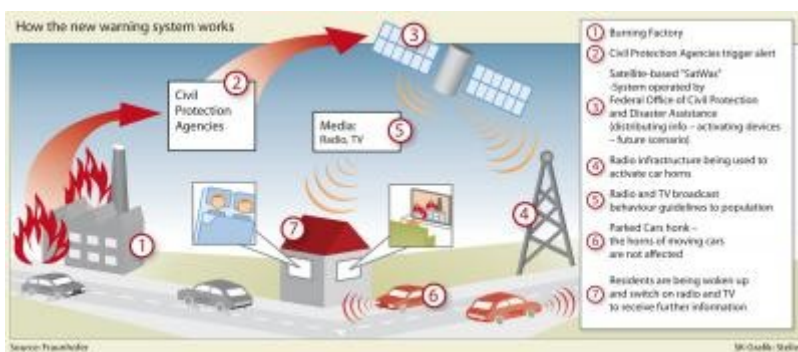
It stops other more sure-footed predators coming along and stealing a captured insect or spider, he says, and any nutrients being washed away by water or rain before the plant can digest them.

Answering such questions is particularly important because the Venus flytrap is becoming increasingly rare in the wild, and should be listed as endangered in the US, where it only lives in North and South Carolina, says Waller. Knowing its evolutionary history will help botanists work out, for example, if it is becoming dangerously inbred.

Car horns warn against natural disasters

This release is available in [German](#).

In Batman's hometown of Gotham City, a gigantic searchlight projects the Bat signal into the sky in case of disaster to alarm the superhero and the population. In Germany, an extensive network of sirens was used in the past to warn the population against disasters: in case of forest fires, industrial accidents or a looming inundation of a part of town, civil protection agencies could trigger the loud and clear siren alarm, while detailed information was provided by radio and television. However, after the end of the Cold War, most sirens were dismantled in the mid-nineties to be replaced by the satellite-based warning system SatWaS, which informs the population only via radio and television. But if TV and radio are switched off, the warning goes unheard.



Car horns warn against natural disasters. Fraunhofer

In recent years, different individual solutions for warning systems have been developed. Cell-broadcast systems can send mass SMS messages to mobile phones. Smoke detectors, radio-controlled clocks and weather stations equipped with radio receivers can also trigger alarm. Despite the high distribution rate of some of these devices, it cannot be ensured that a warning reaches the entire population. Only individual persons or households would be warned, and only if the devices are on standby 24/7/365. Today, fire brigades and disaster protection agencies would rather want the sirens back. However, the resulting costs would amount to several 100 million Euros for German federal and state governments, which share the responsibility for civil protection.

In January, researchers of the INT applied for a patent of a technology which allows the horns of parked cars to be activated in case of disaster. The technology is based on the eCall emergency system, which new cars are going to be equipped with as from September 2010. The eCall system was developed at the initiative of the EU

Commission to help reduce the number of road traffic fatalities. It consists of a GPS sensor and a mobile phone component, which is activated only in case of an accident (i.e. when the airbags are triggered) and which can transmit data (e.g. accident time, coordinates and driving direction of the vehicle) to an emergency call center.

The INT researchers found out that this infrastructure can also be used to warn the population. Once the cars are equipped with a radio receiver, their horns can be triggered in case of disaster. The receiver can be activated only by civil protection agencies. These might send e.g. the following signal to the vehicles: »To all vehicles that are equipped with the receiver and that are currently within the boundaries of the following GPS coordinates: If the engine is off, start sounding the horn!«

Dipl.-Ing. Guido Huppertz from the INT's Technology Analyses and Forecasts (TAV) department has worked on the system and explains the advantages of honking cars: »All hitherto suggested solutions such as mobile phones or smoke detectors only inform the respective device user. The entire population can only be informed if 100% are equipped with these devices.« The INT suggestion has a clear statistical advantage: a mere 14% of the registered vehicles are already sufficient to provide extensive alarming. »If all new vehicles are equipped with eCall from the end of next year, the warning system may be ready for use after an establishment phase of 2 to 4 years,« Huppertz predicts.

The new system is meant to complement rather than replace the other options. »The effort is restricted to the integration of a small electronic module into new vehicles« Huppertz states. »As far as the authorities are concerned, the necessary infrastructure is already available.«

Uterine cells produce their own estrogen during pregnancy

CHAMPAIGN, Ill. — For decades, scientists assumed that the ovary alone produced steroid hormones during pregnancy. In a new study in mice, however, researchers demonstrate that once an embryo attaches to the uterine wall, the uterus itself actually synthesizes the estrogen needed to sustain the pregnancy.

This is the first time that the uterus has been identified as an endocrine organ, said University of Illinois veterinary biosciences professor Indrani Bagchi, who led the study with doctoral student Amrita Das. Their findings appear this week in the Proceedings of the National Academy of Sciences.

"It's the local estrogen that's critical in maintaining the growth of blood vessels within the uterus," Das said. After an embryo implants, the researchers found, this locally produced estrogen acts in concert with progesterone secreted from the ovaries to spur the differentiation of uterine stromal cells, a process called decidualization, and promotes the growth of blood vessels that support the development of the embryo.

The researchers discovered that during decidualization, mouse uterine stromal cells increase their expression of P450 aromatase, a key enzyme that acts with other enzymes to convert androgens to estrogen.

Even in pregnant mice that have had their ovaries removed, the production of uterine estrogen is able to support the growth and differentiation of the tissue and blood vessels needed to sustain the pregnancy.

Progesterone supplementation is required, however, indicating that local estrogen alone is not sufficient to maintain pregnancy. Blocking the activity of the aromatase with an inhibitor also blocked decidualization, the researchers found, another indication that a successful pregnancy relies on estrogen production in uterine cells.

There are advantages to producing the appropriate amount of estrogen right where it is needed, rather than relying on the ovaries, Bagchi said.

"During pregnancy, the ovaries would need to secrete a high level of estrogen to ensure that the right amount of estrogen is present in the uterus to support decidualization," she said. "You can imagine that if the estrogen level goes high systemically, it could have a deleterious effect on pregnancy itself by antagonizing the progesterone action."

The findings may also be helpful to the study of endometriosis, said molecular and integrative physiology professor Milan Bagchi, an author on the study. This disorder involves the growth of endometrial tissue, which is normally shed during menstruation, at sites outside the uterus, such as the peritoneal cavity and ovaries, producing painful lesions. Endometriosis is spurred, in part, by unusually high levels of estrogen secreted from endometrial tissue growing at these extrauterine sites, he said.

Except during pregnancy, "a normal cycling uterus does not make estrogen," he said. High estrogen levels block the activity of progesterone and can cause the non-cancerous growth of tissue seen in endometriosis.

This study was supported by the National Institutes of Health (NIH) and by the Eunice Kennedy Shriver National Institute of Child Health and Human Development at the NIH as part of the Specialized Cooperative Centers Program in Reproduction and Infertility Research.

Did great balls of fire form the planets?

* 20 July 2009 by David Shiga

ASTEROID-SIZED balls of magma hurtled through our infant solar system, and spray from their many collisions provided much of the raw material that formed Earth and its rocky siblings. That's according to a new take on an old theory that challenges the notion that the solar system started out as a placid sea of dust motes which simply clumped together to form planets.

The early family tree of our solar system's rocky planets features tiny glassy spheres called chondrules, found today inside ancient meteorites.

Explosive collisions of giant, radioactive magma balls may have made the planets Illustration: sgeier

The origins of chondrules, which are typically about a millimetre across, are shrouded in mystery. They make up much of the material preserved in meteorites that were formed about 2 million years after the solar system began and are thought to have clumped together to form asteroid-size planetesimals, which in turn agglomerated to make Earth and its peers.

Chondrules' glassy composition and spheroidal shape show that they were once molten. According to the popular view, they formed when dust grains in the nebula surrounding the infant sun were suddenly heated, perhaps when cosmic lightning or shock waves shot through the nebula.

But calculations published in 2008 on the retention of sodium by the chondrules suggest they formed in dense swarms (Science, vol 320, p 1617). This is difficult to reconcile with the melting of dust motes in a nebula, which are expected to be widely spaced.

Now, Ian Sanders of Trinity College Dublin in Ireland says another formation scenario, involving collisions between asteroid-sized balls of magma - kept molten through their high radioactivity - offers a better explanation. Sanders renewed the case for the idea, first proposed in the 1980s, at this week's meeting of the Meteoritical Society in Nancy, France.

Decay of radioactive isotopes today helps to keep the cores of relatively large bodies like Earth molten. Sanders argues that the greater abundance of radioactive material in the fledgling solar system means that if objects larger than 30 kilometres across formed, they would have melted through. Collisions between such magma balls would breach their thin crusts of solid rock, spraying molten material into space, where the droplets would quickly cool to form chondrules. Collisions between magma balls would breach their thin crusts and spray material into space

"It puts a completely different slant on what happened in the early solar system in the first 2 million years," Sanders says. That is the period when chondrules formed, based on measurements of key isotopes within them.

Conel Alexander of the Carnegie Institution of Washington DC, who led last year's Science study, says the high density of droplets possible in plumes ejected from magma balls could explain his team's results, but finds the idea hard to accept on other grounds. A key issue is that material within magma balls should have quickly sorted into chemically distinct layers, with iron sinking to the core and lighter elements near the surface. The chemical signature of such sorting is not present in chondrules, Alexander says.

Sanders notes that some of the chondrules are indeed depleted in iron, as might be expected if they splashed from near the surface of a layered liquid body, though such chondrules are in a minority.

Common cold virus efficiently delivers corrected gene to cystic fibrosis cells

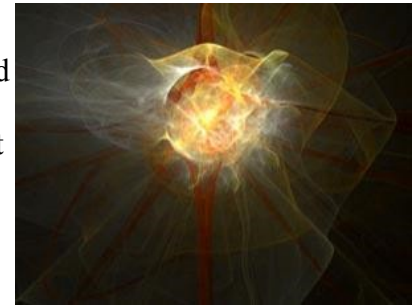
CHAPEL HILL – Scientists have worked for 20 years to perfect gene therapy for the treatment of cystic fibrosis, which causes the body to produce dehydrated, thicker-than-normal mucus that clogs the lungs and leads to life threatening infections.

Now University of North Carolina at Chapel Hill School of Medicine scientists have found what may be the most efficient way to deliver a corrected gene to lung cells collected from cystic fibrosis patients. They also showed that it may take this high level of efficiency for cystic fibrosis (CF) patients to see any benefit from gene therapy.

Using parainfluenza virus, one of the viruses that causes common colds, the UNC scientists found that delivery of a corrected version of the CFTR gene to 25 percent of cells grown in a tissue culture model that resembles the lining of the human airways was sufficient to restore normal function back to the tissue.

"This is the first demonstration in which we've been able to execute delivery in an efficient manner," said Ray Pickles, Ph.D., associate professor of microbiology and immunology at the UNC Cystic Fibrosis Research and Treatment Center. "When you consider that in past gene therapy studies, the targeting efficiency has been somewhere around 0.1 percent of cells, you can see this is a giant leap forward."

"We discovered that if you take a virus that has evolved to infect the human airways, and you engineer a normal CFTR gene into it, you can use this virus to correct all of the hallmark CF features in the model system



that we used," Pickles said. For instance, the experiment improved the cells' ability to hydrate and transport mucus secretions. The resulting paper is published in the July 21 issue of the journal PLoS Biology.

Now the researchers must work to ensure the safety of the delivery system. In a pleasant surprise, simply adding the CFTR gene to the virus significantly attenuated it, potentially reducing its ability to cause inflammation. But the scientists may need to alter the virus further.

"We haven't generated a vector that we can go out and give to patients now," Pickles said, "but these studies continue to convince us that a gene replacement therapy for CF patients will some day be available in the future."

In addition to Pickles, UNC co-authors are Liqun Zhang Ph.D., research associate, CF Center; Brian Button Ph.D., assistant professor, CF Center; Sherif E. Gabriel Ph.D., associate professor, pediatrics; Susan Burkett, research analyst, CF Center; Yu Yan, research specialist, CF Center; Yan Li Dang, research specialist, CF Center; Tristan McKay Ph.D., postdoctoral fellow, CF Center; and Richard C. Boucher M.D., Kenan Professor of Medicine, director, CF Center.

Other co-authors are April Mengos of the Mayo Clinic College of Medicine, as well as Mario H. Skiadopoulos, Ph.D., Leatrice N. Vogel and Peter L. Collins Ph.D., all of the National Institute of Allergy and Infectious Diseases, National Institutes of Health. The research was funded by the National Institutes of Health and the Cystic Fibrosis Foundation.

Girl with half a brain retains full vision

* 20:48 20 July 2009 **by Ewen Callaway**

A 10-year old girl born with half of her cerebral cortex missing sees perfectly because of a massive reorganisation of the brain circuits involved in vision, a new study finds.

"It was quite a surprise to see that something like this is possible," says Lars Muckli, a neuroscientist at the University of Glasgow, UK, who was part of the team that imaged the girl's brain. Doctors discovered that she was missing the right half at the age of three, after she began suffering from seizures.

Normal life

However, the seizures proved treatable and the girl – known as AH – lives an otherwise normal life. The left side of her body is slightly weaker than the right, but this hasn't stopped her from bicycling or roller-skating.

But what's most amazing, Muckli says, is her ability to see out of the left and right visual fields. Patients who have half of their cortex removed to treat epilepsy invariably lose half of their visual field. "They would only see half of the world; this is what's expected," he says.

That's because, each eye sends visual signals to two different halves of the brain via two distinct bundles of nerves. The nerves on the side of the eye nearest the nose are routed to the opposite side of the brain. The nerves nearest the temple, however, send information to the same side of the brain as the eye.

For example, the nose side of the left eye sends left visual field data to the right side of the brain; while the temple side of the left eye sends right visual field data to the left side of the brain.

For this reason, the right side of the brain processes our left visual field, and vice versa.

Rerouted neurons

AH, on the other hand, has no right hemisphere to receive any signal from her left visual field. What's more, her right eye never developed, so she should get visual information only from one half of her left eye – that is, from just one nerve bundle.

Brain scans performed by Muckli's team explain why that's not the case. Her retinal nerves that should normally connect to the right half of her brain instead set up shop in two parts of the left brain: the thalamus and the visual cortex. In some cases, the diverted nerves seemed to have followed the molecular cues that would have guided nerves from the right eye, were they not missing. But for the most part, the left visual field neurons carved out their own islands in the right brain, Muckli says.

This kind of organisation allows AH's brain to process the left and right fields of vision distinctly from one another, ensuring that she sees both halves of her world.

"It's fascinating to have someone who is absolutely, completely behaving normally and then knowing she only has half of a brain," Muckli says.

Journal reference: Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0809688106 (in press)

Really?

The Claim: Red Wine Is Better for You Than White

By ANAHAD O'CONNOR

THE FACTS Summer is the season for chilled white wine. But does red hold the year-round advantage when it comes to good health?

Many studies have shown that red wine has healthful compounds that are less abundant in white, including resveratrol, the heart-healthy substance derived from grape skins. Because white wine is produced with limited exposure to the skin, it contains lower levels of resveratrol, not to mention flavonoids, antioxidants, and the bitter-tasting tannins that are also linked to cardiovascular health.

According to studies, the wines with the greatest amounts of those compounds come from Sardinia, Spain and southwestern France, in particular those from the grape grenache.

One caveat: few epidemiological studies have compared white to red. And of those that have, some have demonstrated an advantage for red, while others have not. And still others have indicated that the drinkers of red and white are too different to compare. One study, found that red drinkers had a significantly lower risk of colon cancer than white drinkers, but the researchers later explained that among other things, the white drinkers were also more likely to smoke, which could have made the difference.

The best answer may be to go with your palate, so long as you remember moderation.

THE BOTTOM LINE On red vs. white, the evidence is mixed.

Basics

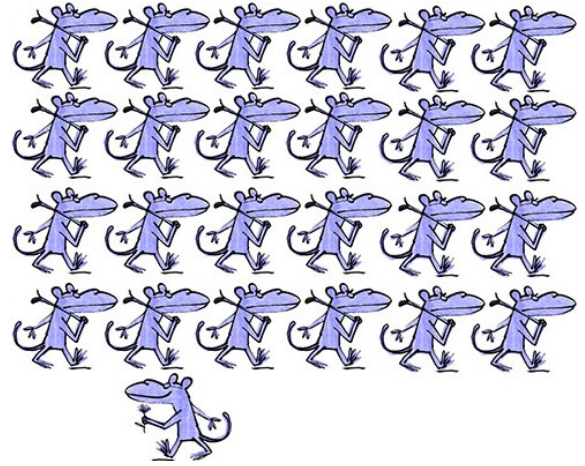
When 'What Animals Do' Doesn't Seem to Cover It

By NATALIE ANGIER

Certain things should never be taken for granted, among them your spouse, your mother, the United States Constitution, and the precise meaning of words that are at the heart of your profession.

Daniel Levitis was working as a teaching assistant for an animal behavior course at the University of California in Berkeley, and on the first day of class, the professor explained that the shorthand definition of a "behavior" is "what animals do."

O.K., that's the freshman-friendly definition, Mr. Levitis thought. Now how about the unabridged, professional version?



Serge Bloch

What is the point-by-point definition of a behavior that behavioral biologists use when judging whether a particular facet of the natural world falls under their purview? After all, animals digest food and grow fur, yet few behavioral researchers would count such physiological and anatomical doings as behaviors.

Mr. Levitis asked the professor for the full definition of a behavior. She referred him to their textbook, with its promising title, "Animal Behavior." To his surprise, neither that textbook nor any other reference he consulted bothered to spell it out. "It was assumed that everyone knew what the word meant," said Mr. Levitis, who is completing his doctorate at Berkeley.

Mr. Levitis decided to ask the people who should know best: working behavioral biologists. The provocative and crisply written results of his quest, carried out with his colleagues, William Lidicker Jr. and Glenn Freund, appear in the current issue of the journal *Animal Behaviour*. Among the highlights of the report: biologists don't agree with one another on what a behavior is; biologists don't agree with themselves on what a behavior is; biologists can be as parochial as the rest of us, meaning that animal behaviorists tend to reflexively claim the behavior label for animals only, while botanists sniff that, if the well-timed unfurling of a smelly, colorful blossom for the sake of throwing your seed around isn't the ultimate example of a behavior, then there's no such thing as Valentine's Day; and, finally, words may count, but thoughts do not.

The researchers acknowledged that biologists had not been crying out for a canonical definition of the term. Marlene Zuk, an animal behaviorist at the University of California at Riverside, contrasted that casual attitude with the often acrid debates now under way on how to define the term species. "What you think a species is means a lot for the way you think about evolution," she said. But with behavior, she added, "there doesn't seem to be an existential crisis." Then again, nothing can be more insidious than the wallflower you ignore.

Walter D. Koenig of Cornell University, who helped Mr. Levitis in the early stages of the project, said his interest was piqued when he moved from the study of bird behavior to an investigation of the birds' primary food supplier, oak trees. Why is it that trees dispersed over great distances end up releasing their acorns, or masting, en masse, he wondered. "Are the trees responding to something produced by other trees?" he said. "It's entirely possible." And if you designate this sort of inter-arboreal chemistry a behavior, he added, "it ends up pushing the boundaries" of what you think plants can do.

To perform their linguistic investigation, the researchers composed an online survey with two basic parts. In the first, they presented 13 "potentially diagnostic" statements about behavior, compiled from their sweep through the scientific literature, with which respondents could either concur or not. "Behavior always involves movement," for example, and "is always an action, rather than a lack of action." Or, "behaviors are always the actions of individuals, not groups" and "something whole individuals do, not organs or parts that make up an individual." Or, "a developmental change is not a behavior."

In the second part, Mr. Levitis and his co-workers offered 20 instances of natural phenomena and asked, Behavior, yea, nay or can't say? "A sponge pumps water to gather food," for example, or "a plant bends its leaves toward a light source" or "a beetle is swept away by a strong current." Does a flock of geese flying in V formation count as a behavior? How about when a person decides not to do anything tomorrow in the event of rain, or when a female ant that is physiologically capable of laying eggs doesn't do so because she's not a queen? (If you'd like to take the survey and see how your responses compare with scientists' and other readers', please go to nytimes.com/science. Warning, spoilers ahead.)

Nearly all of the items were designed as borderline cases that tested the validity of one or more statements in the first half of the survey. "Flocks of geese fly in V formation," for instance, contradicted the notion that behaviors are the actions of individuals rather than of groups. A person deciding on inactivity in the event of rain and an ant forgoing reproduction because she's not royalty both flouted the premise that a behavior is always an action. One offering, "a spider builds a web," contradicted none of the 13 stipulations about behavior and thus served as an experimental control.

Tallying results from 174 respondents, the researchers found an impressive lack of accord. "We didn't have complete consensus for any item on the survey," said Mr. Levitis, and that includes the little eight-legged control spinning its web. There were some harmonic notes. All but one participant deemed geese flying in V formation to be a legitimate behavior, while more than 95 percent turned thumbs down to the beetle swept away in a stream.

Amusingly, more than half the scientists contradicted themselves, some of them multiple times, by designating as behaviors items on the second list that defied the set of rules they had chosen from the first list.

Despite the overall lack of concordance, the researchers sought to extract from the results a trial definition for a word their peers bandy about with abandon. As they pitch it, a behavior is the internally coordinated response that an individual or a group makes to a stimulus. The response can be action or lack of action. The stimulus can come from inside or out. By this definition, masting oak trees, bacterial colonies creeping across a sugar gradient, zebra herds fissioning and fusing, are all displaying behaviors. Dogs that bark are behaving, dogs that obey a trainer's signal and choose not to bark are most definitely behaving.

Yet a favorite human sport fails to meet the new lexical guidelines. Thinking, it seems, is not a behavior. If you think about going for a walk and then go for a walk, that's a behavior. If you think about going for a walk but then decide it's too cold, that's a behavior. Walk or not, just make up your mind. It don't mean a thing till you get off that swing.

Jupiter sports new 'bruise' from impact

* Updated 19:29 21 July 2009 by **Lisa Grossman**

Something has smashed into Jupiter, leaving behind a black spot in the planet's atmosphere, scientists confirmed on Monday.

This is only the second time such an impact has been observed. The first was almost exactly 15 years ago, when more than 20 fragments of comet Shoemaker-Levy 9 collided with the gas giant.

"This has all the hallmarks of an impact event, very similar to Shoemaker-Levy 9," said Leigh Fletcher, an astronomer at NASA's Jet Propulsion Lab in Pasadena, California. "We're all extremely excited."

The impact was discovered by amateur astronomer Anthony Wesley in Murrumbateman, Australia at about 1330 GMT on Sunday. Wesley noticed a black spot in Jupiter's south polar region (see image) – but he very nearly stopped observing before he saw it.

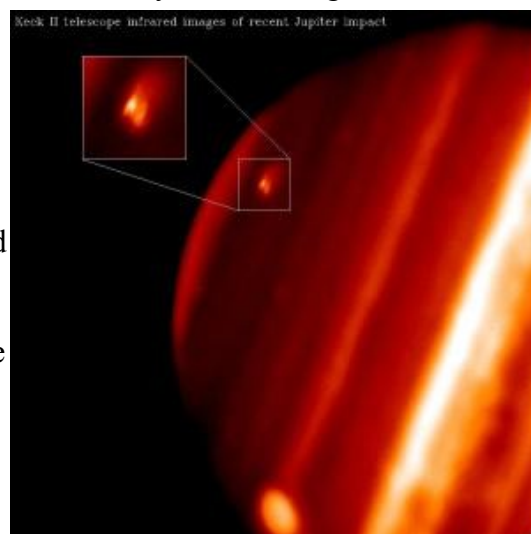
"By 1am I was ready to quit ... then changed my mind and decided to carry on for another half hour or so," he wrote in his observation report. Initially he suspected he was seeing one of Jupiter's moons or a moon's shadow on the planet, but the location, size and speed of the spot ruled out that possibility.

'Stroke of luck'

After checking images taken two nights earlier and not seeing the spot, he realised he had found something new and began emailing others.

Infrared observations taken at the Keck II telescope in Hawaii reveal a bright spot where the impact occurred. The spot looks black at visible wavelengths (Image: Paul Kalas/Michael Fitzgerald/Franck Marchis/LLNL/UCLA/UC

Berkeley/SETI Institute)



Among the people he contacted were Fletcher and Glenn Orton, also at JPL. They had serendipitously scheduled observing time on NASA's InfraRed Telescope Facility in Hawaii for that night.

"It was a fantastic stroke of luck," Orton told New Scientist.

Their team began observations at about 1000 GMT on 20 July, and after six hours of observing confirmed that the spot was an impact and not a weather event.

"It's completely unlike any of the weather phenomena that we observe on Jupiter," Orton says.

Splash

The first clue was a near-infrared image of the upper atmosphere above the impact site. An impact would make a splash like a stone thrown into a pool, scattering material in the atmosphere upwards. This material would then reflect sunlight, appearing as a bright spot at near-infrared wavelengths.

And that's exactly what the team saw. "Our first image showed a really bright object right where that black scar was, and immediately we knew this was an impact," Orton says. "There's no natural phenomenon that creates a black spot and bright particles like that."

Supporting evidence came from measurements of Jupiter's temperature. Thermal images also showed a bright spot where the impact took place, meaning the impact warmed up the lower atmosphere in that area.

The researchers have also found hints of higher-than-normal amounts of ammonia in the upper atmosphere. Extra ammonia had been churned up by the previous Shoemaker-Levy comet impact.

Exotic chemistry

The Shoemaker-Levy impact also introduced some exotic chemistry into Jupiter's atmosphere. The energy from the collision fused some of the original atmospheric components into new molecules, such as hydrogen cyanide. Scientists hope this new impact has done the same thing, since that would allow them to follow the new materials and learn how the atmosphere moves with time.

So what was the impactor? "Not a clue," Orton says. He speculates that it could have been a block of ice from somewhere in Jupiter's neighborhood, or a wandering comet that was too faint for astronomers to detect before the impact.

"We don't know if the impact was produced by a comet or an asteroid," agrees Franck Marchis, an astronomer at the University of California, Berkeley, and the SETI Institute, who was part of a team that observed the spot on Sunday with the Keck Observatory in Hawaii (see image). If the object was large enough to be visible before impact, current surveys of asteroids may not have been looking in the right direction to find it, he says, adding that future surveys will spot more of the solar system's uncatalogued objects.

Asteroid or comet

Spectra collected by various observatories may help identify what the impactor was, since a large amount of water at the impact location would hint at a comet as the source. "We will also compare the observations with those collected during [Shoemaker-Levy 9] 15 years ago," since that was a known comet, Marchis says.

Without having seen it, scientists can't tell how large the object was. "But the impact scar we're seeing is about the same size as one of Jupiter's big storms, Oval BA, Fletcher told New Scientist. "That, I believe, is about the size of the Earth."

Marchis says Jupiter may be protecting Earth from getting hit by such objects. "The solar system would have been a very dangerous place if we did not have Jupiter," he told New Scientist. "We should thank our Giant Planet for suffering for us. Its strong gravitational field is acting like a shield protecting us from comets coming from the outer part of the solar system."

Neural stem cells offer potential treatment for Alzheimer's disease

Transplanted cells 'nurse' brain back to health

Irvine, Calif. – UC Irvine scientists have shown for the first time that neural stem cells can rescue memory in mice with advanced Alzheimer's disease, raising hopes of a potential treatment for the leading cause of elderly dementia that afflicts 5.3 million people in the U.S.

Mice genetically engineered to have Alzheimer's performed markedly better on memory tests a month after mouse neural stem cells were injected into their brains. The stem cells secreted a protein that created more neural connections, improving cognitive function.

"Essentially, the cells were producing fertilizer for the brain," said Frank LaFerla, director of UCI's Institute for Memory Impairments and Neurological Disorders, or UCI MIND, and co-author of the study, which appears online the week of July 20 in the Proceedings of the National Academy of Sciences.

Lead author Mathew Blurton-Jones, LaFerla and colleagues worked with older mice predisposed to develop brain lesions called plaques and tangles that are the hallmarks of Alzheimer's.

To learn how the stem cells worked, the scientists examined the mouse brains. To their surprise, they discovered that just 6 percent of the stem cells had turned into neurons. (The majority became the other two

main types of brain cells, astrocytes and oligodendrocytes.) The stem cells didn't improve cognition by becoming new neurons, nor did they act by reducing the number of plaques and tangles.

Rather, the stem cells were found to have secreted a protein called brain-derived neurotrophic factor, or BDNF. This caused existing tissue to sprout new neurites, strengthening and increasing the number of connections between neurons. When the team selectively reduced BDNF from the stem cells, the benefit was lost, providing strong evidence that BDNF is critical to the effect of stem cells on memory and neuronal function.

"If you look at Alzheimer's, it's not the plaques and tangles that correlate best with dementia; it's the loss of synapses – connections between neurons," Blurton-Jones said. "The neural stem cells were helping the brain form new synapses and nursing the injured neurons back to health."

Diseased mice injected directly with BDNF also improved cognitively but not as much as with the neural stem cells, which provided a more long-term and consistent supply of the protein.

"This gives us a lot of hope that stem cells or a product from them, such as BDNF, will be a useful treatment for Alzheimer's," LaFerla said.

In April, LaFerla, Blurton-Jones and colleagues were awarded \$3.6 million by the California Institute for Regenerative Medicine toward the development of an Alzheimer's therapy involving human neural stem cells.

In addition to LaFerla and Blurton-Jones, Masashi Kitazawa, Hilda Martinez-Coria, Nicholas Castello, Tritia Yamasaki, Wayne Poon and Kim Green of UCI worked on the study, along with Franz-Josef Muller and Jeanne Loring of the Scripps Research Institute. Funding for the study was provided by the California Institute for Regenerative Medicine and the National Institutes of Health.

Babies understand dog-speak, BYU study finds

New research shows babies have a handle on the meaning of different dog barks – despite little or no previous exposure to dogs. Infants just 6 months old can match the sounds of an angry snarl and a friendly yap to photos of dogs displaying threatening and welcoming body language.

The new findings come on the heels of a study from the same Brigham Young University lab showing that infants can detect mood swings in Beethoven's music.

Though the mix of dogs and babies sounds silly, experiments of this kind help us understand how babies learn so rapidly. Long before they master speech, babies recognize and respond to the tone of what's going on around them. "Emotion is one of the first things babies pick up on in their social world," said BYU psychology professor Ross Flom, lead author of the study.

Flom and two BYU students report their latest "amazing baby" findings in the journal *Developmental Psychology*. "We chose dogs because they are highly communicative creatures both in their posture and the nature of their bark," Flom said.

In the experiment, the babies first saw two different pictures of the same dog, one in an aggressive posture and the other in a friendly stance. Then the researchers played – in random order – sound clips of a friendly and an aggressive dog bark.

[Play aggressive bark](#)

[Play friendly bark](#)

"They only had one trial because we didn't want them to learn it on the fly and figure it out," Flom said.

While the recordings played, the 6-month-old babies spent most of their time staring at the appropriate picture. Older babies usually made the connection instantly with their very first glance.

Study co-authors Dan Hyde and Heather Whipple Stephenson conducted the experiments as undergrads and don't recall any babies getting upset.

"Many of them enjoyed it," said Hyde. "Others just looked."

"Infants are pretty cooperative subjects," Stephenson added.



The pairs of photos used in the experiment.

The mentored research experience helped Hyde and Stephenson secure spots at prestigious grad schools. Hyde is currently at Harvard working toward a Ph.D. in developmental psychology. Fellow co-author Heather Whipple Stephenson recently completed a master's degree in educational psychology at the University of Minnesota.

"With this study, my favorite part was watching a somewhat zany idea grow into a legitimate research project," Stephenson said.

Sea lamprey jettison one-fifth of their genome

Growing lamprey embryos discard millions of units of their DNA

Researchers have discovered that the sea lamprey, which emerged from jawless fish first appearing 500 million years ago, dramatically remodels its genome. Shortly after a fertilized lamprey egg divides into several cells, the growing embryo discards millions of units of its DNA.

The findings were published this month in the Proceedings of the National Academy of Sciences. The lead author is Jeramiah Smith, a postdoctoral fellow in genome sciences at the University of Washington (UW) working in the Benaroya Research Institute laboratory of Chris Amemiya, who is also a UW affiliate professor of biology.

Theirs is believed to be the first recorded observation of a vertebrate -- an animal with a spinal column -- extensively reorganizing its genome as a normal part of development. A few invertebrate species, like some roundworms, have been shown to undergo extensive genome remodeling. However, stability was thought to be vital in vertebrates' genomes to assure their highly precise, normal functioning. Only slight modifications to allow for immune response were believed to occur in the vertebrate genome, not broad-scale rearrangements.

Smith, Amemiya and their research team inadvertently discovered the dynamic transformations in the sea lamprey genome while studying the genetic origins of its immune system. The researchers were trying to deduce how the sea lamprey employs a copy-and-paste mechanism to generate diverse receptors for detecting a variety of pathogens.

The researchers were surprised to notice a difference between the genome structure in the germline -- the cells that become eggs and the sperm that fertilize them -- and the genome structure in the resulting embryonic cells. The DNA in the early embryonic cells had myriad breaks that resembled those in dying cells ...but the cells weren't dying. The embryonic cells had considerably fewer repeat DNA sequences than did the sperm cells and their precursors.

"The remodeling begins at the point when the embryo turns on its own genes and no longer relies on its mom's store of mRNA," said Smith.

The restructuring doesn't occur all at once, but continues for a long while during embryonic development. It took a lot of work for the scientists to see what was lost and when. They learned, among other findings, that the remodeled genome had fewer repeats and specific gene-encoding sequences. Deletions along the strands of DNA are also thought to move certain regulatory switches in the genome closer to previously distant segments.

The scientists don't know how this happens, or why. Smith said that his favorite hypothesis, yet unproven, is that the extra genetic material might play a role in the proliferation of precursor cells for sperm and eggs, and in early embryonic development. The genetic material might then be discarded either when it is no longer needed or to prevent abnormal growth.

The alteration of the sea lamprey genome and of invertebrates that restructure their genome appears to be tightly regulated, according to Smith, yet the resulting structural changes seem almost like the DNA errors that give rise to cancers or other genomic disorders in higher animals. Learning how sea lamprey DNA rearrangements are regulated during development might provide information on what stabilizes or changes the genome, he said, as well the role of restructuring in helping form different types of body cells, like fin, muscle, or liver cells.

If 20 percent of their genome disappears, how do sea lampreys pass along the full complement of their genes to their offspring?

"The germline - those precursor cells for sperm and eggs -- is a continuous lineage through time," Smith explained. "The precursor cells for sperm and egg are set apart early in lamprey development. The genome in that cell population should never change." Genetic material is assumed to be lost only in the early embryonic cells destined to become body parts and not in cells that give rise to the next generation. The researchers have been looking for the primordial stem cells for sperm and eggs hidden away in the lamprey, but they are difficult to find.

Researchers do not yet know how the sea lamprey's genome guides the morphing it undergoes during its life. Sea lampreys have a long juvenile life as larvae in fresh water, where they eat on their own. Their short adult lives are normally spent in the sea as blood-sucking parasites. Their round, jawless mouths stick like suction cups to other fish. Several circular rows of teeth rasp through the skin of their unlucky hosts. Their appetite is voracious.

Later, as they return to streams and rivers along the northern Atlantic seaboard, sea lampreys atrophy until they are little more than vehicles for reproduction. After mating, they perish. Populations of sea lamprey were landlocked in the Great Lakes and other nearby large lakes after canals and dams were built in the early 1900's.

They thrive by parasitizing (and killing) commercially important fish species and are considered a nuisance in the Great Lakes region.

Biologists are interested in the sea lamprey partly because of its alternating lifestyles, but largely because it represents a living fossil from around the time vertebrates originated. Close relatives of sea lampreys were on earth before the dinosaurs. It's possible that the sea lamprey's dynamic genome biology might someday be traced back in evolutionary history to a point near, and perhaps including, a common ancestor of all vertebrates living today, the authors of the study noted.

"Sea lampreys have a half billion years of evolutionary history," Smith said. "Evolutionary biologists and geneticists can compare their genomes to other vertebrates and humans to see what parts of the lamprey genome might have been present in our primitive ancestors. We might begin to understand how changes in the sea lamprey genome led to their distinct body structure and how fishes evolved from jawless to jawed."

Amemiya added, "We don't really know where this discovery about the sea lamprey's remodeling of its genome will take us. It's common in science for the implications of a finding not to be realized for several decades. It's less about connecting the dots to a specific application, and more about obtaining a broad understanding of how living things are put together."

In addition to Smith and Amemiya, the other researchers on this study were Francesca Antonacci and Evan E. Eichler of the UW Department of Genome Sciences. Research grants from the National Institutes of Health, the National Science Foundation and the Howard Hughes Medical Institute funded the project. Smith also received National Research Service Awards, including an Institutional Ruth L. Kirschstein Award through the University of Washington Department of Genome Sciences and an individual Ruth L. Kirschstein Award through the National Institute of General Medical Sciences.

UCLA scientists present first genetic evidence for why placebos work **Researchers find genetic link to placebo response in depressive disorder**

Placebos are a sham - usually mere sugar pills designed to represent "no treatment" in a clinical treatment study. The effectiveness of the actual medication is compared with the placebo to determine if the medication works.

And yet, for some people, the placebo works nearly as well as the medication. How well placebos work varies widely among individuals. Why that is so, and why they work at all, remains a mystery, thought to be based on some combination of biological and psychological factors.

Now, researchers at UCLA have found a new explanation: genetics. Dr. Andrew Leuchter, a professor of psychiatry at the UCLA Semel Institute for Neuroscience and Human Behavior, and colleagues report that in people suffering from major depressive disorder, or MDD, genes that influence the brain's reward pathways may modulate the response to placebos. The research appears in the August edition of the *Journal of Clinical Psychopharmacology* (currently available online by subscription).

Placebos are thought to act by stimulating the brain's central reward pathways by releasing a class of neurotransmitters called monoamines, specifically dopamine and norepinephrine. These are the brain chemicals that make us "feel good." Because the chemical signaling done by monoamines is under strong genetic control, the scientists reasoned that common genetic variations between individuals - called genetic polymorphisms - could influence the placebo response.

Researchers took blood samples from 84 people diagnosed with MDD; 32 were given medication and 52 a placebo. The researchers looked at the polymorphisms in genes that coded for two enzymes that regulate monoamine levels: catechol-O-methyltransferase (COMT) and monoamine oxidase A (MAO-A). Subjects with the highest enzyme activity within the MAO-A polymorphism had a significantly lower placebo response than those with other genotypes. With respect to COMT, those with lower enzyme activity within this polymorphism had a lower placebo response.

"Our findings suggest that patients with MDD who have specific MAO-A and COMT genotypes may be biologically advantaged or disadvantaged in mounting a placebo response, because of the activity of these two enzymes," said Leuchter, who directs the Laboratory of Brain, Behavior and Pharmacology at the UCLA Semel Institute. "To our knowledge, this is the first study to examine the association between MAO-A and COMT polymorphisms and a response to placebo in people who suffer from major depressive disorder," he said.

Leuchter noted that this is not the sole explanation for a response to a placebo, which is likely to be caused by many factors, both biological and psychosocial. "But the data suggests that individual differences in response to placebo are significantly influenced by individual genotypes," he said.

Including the influence of genotype in the design of clinical trials could facilitate more powerful testing of future treatments, Leuchter said.

Funding for the study was provided by the National Center for Complementary and Alternative Medicine of the National Institutes of Health, Eli Lilly and Co., and Pfizer Inc.

Other authors included James McCracken, Aimee Hunter and Ian Cook, all of UCLA, and Jonathan Alpert of Massachusetts General Hospital and Harvard University.

Author disclosure information:

Dr. Andrew Leuchter has provided scientific consultation or served on advisory boards of a number of companies, including Eli Lilly and Co., where he has also served in the speakers bureau. He has received research/grant support from the National Center for Complementary and Alternative Medicine, Eli Lilly and Co., and Pfizer Inc., among others.

Dr. James T. McCracken has served as an adviser and consultant for Eli Lilly and Co. and other companies and receives research support from, among others, Eli Lilly and Co.

Aimee M. Hunter has nothing to disclose financially.

Dr. Ian A. Cook has served in the speakers bureau for Pfizer Pharmaceuticals Inc. and other companies and has received research support from, among others, Eli Lilly and Co. and Pfizer Inc.

Dr. Jonathan E. Alpert has served as an adviser and consultant for Eli Lilly and Co. and other companies and has served in the speakers bureau for Eli Lilly and Co. He receives research support from, among others, Eli Lilly and Co. and Pfizer Inc.

Researchers turn cell phones into fluorescent microscopes

CellScope project to bring low-cost lab tools to the field

Berkeley - Researchers at the University of California, Berkeley, are proving that a camera phone can capture far more than photos of people or pets at play. They have now developed a cell phone microscope, or CellScope, that not only takes color images of malaria parasites, but of tuberculosis bacteria labeled with fluorescent markers.

The prototype CellScope, described in the July 22 issue of the online journal PLoS ONE, moves a major step forward in taking clinical microscopy out of specialized laboratories and into field settings for disease screening and diagnoses.

"The same regions of the world that lack access to adequate health facilities are, paradoxically, well-served by mobile phone networks," said Dan Fletcher, UC Berkeley associate professor of bioengineering and head of the research team developing the CellScope. "We can take advantage of these mobile networks to bring low-cost, easy-to-use lab equipment out to more remote settings."

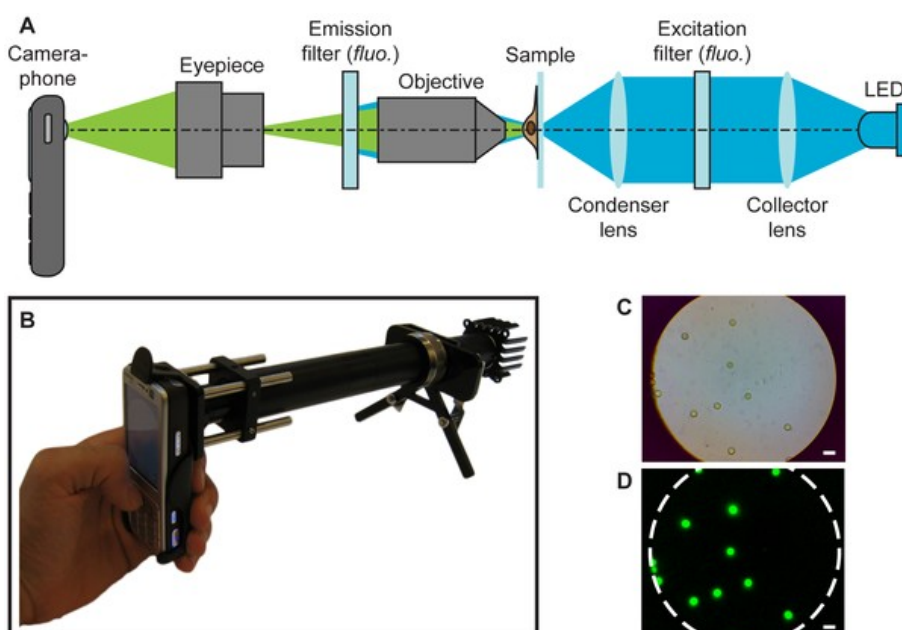
Mobile phone microscopy optical layout for fluorescence imaging. The same apparatus was used for brightfield imaging, with the filters and LED removed. Components only required for fluorescence imaging are indicated by "fluo." Not to scale. (b) A current prototype, with filters and LED installed, capable of fluorescence imaging. The objective is not visible because it is contained within the optical tubing, and the sample is mounted adjacent to the metallic focusing knob. (c) Brightfield image of 6 μm fluorescent beads. (d) Fluorescent images of beads shown in (c). The field-of-view projected onto the camera phone CMOS is outlined. Scales bars are 10 μm .

The engineers attached compact microscope lenses to a holder fitted to a cell phone. Using samples of infected blood and sputum, the researchers were able to use the camera phone to capture bright field images of Plasmodium falciparum, the parasite that causes malaria in humans, and sickle-shaped red blood cells. They were also able to take fluorescent images of Mycobacterium tuberculosis, the bacterial culprit that causes TB in humans. Moreover, the researchers showed that the TB bacteria could be automatically counted using image analysis software.

"The images can either be analyzed on site or wirelessly transmitted to clinical centers for remote diagnosis," said David Breslauer, co-lead author of the study and a graduate student in the UC San Francisco/UC Berkeley Bioengineering Graduate Group. "The system could be used to help provide early warning of outbreaks by shortening the time needed to screen, diagnose and treat infectious diseases."

The engineers had previously shown that a portable microscope mounted on a mobile phone could be used for bright field microscopy, which uses simple white light - such as from a bulb or sunlight - to illuminate samples. The latest development adds to the repertoire fluorescent microscopy, in which a special dye emits a specific fluorescent wavelength to tag a target - such as a parasite, bacteria or cell - in the sample.

"Fluorescence microscopy requires more equipment - such as filters and special lighting - than a standard light microscope, which makes them more expensive," said Fletcher. "In this paper we've shown that the whole



fluorescence system can be constructed on a cell phone using the existing camera and relatively inexpensive components."

The researchers used filters to block out background light and to restrict the light source, a simple light-emitting diode (LED), to the 460 nanometer wavelength necessary to excite the green fluorescent dye in the TB-infected blood. Using an off-the-shelf phone with a 3.2 megapixel camera, they were able to achieve a spatial resolution of 1.2 micrometers. In comparison, a human red blood cell is about 7 micrometers in diameter.

"LEDs are dramatically more powerful now than they were just a few years ago, and they are only getting better and cheaper," said Fletcher. "We had to disabuse ourselves of the notion that we needed to spend many thousands on a mercury arc lamp and high-sensitivity camera to get a meaningful image. We found that a high-powered LED - which retails for just a few dollars - coupled with a typical camera phone could produce a clinical quality image sufficient for our goal of detecting in a field setting some of the most common diseases in the developing world."

The researchers pointed out that while fluorescent microscopes include additional parts, less training is needed to interpret fluorescent images. Instead of sorting out pathogens from normal cells in the images from standard light microscopes, health workers simply need to look for something the right size and shape to light up on the screen.

"Viewing fluorescent images is a bit like looking at stars at night," said Breslauer. "The bright green fluorescent light stands out clearly from the dark background. It's this contrast in fluorescent imaging that allowed us to use standard computer algorithms to analyze the sample containing TB bacteria."

Breslauer added that these software programs can be easily installed onto a typical cell phone, turning the mobile phone into a self-contained field lab and a "good platform for epidemiological monitoring."

While the CellScope is particularly valuable in resource-poor countries, Fletcher noted that it may have a place in this country's health care system, famously plagued with cost overruns.

"A CellScope device with fluorescence could potentially be used by patients undergoing chemotherapy who need to get regular blood counts," said Fletcher. "The patient could transmit from home the image or analyzed data to a health care professional, reducing the number of clinic visits necessary."

The CellScope developers have even been approached by experts in agriculture interested in using it to help diagnose diseases in crops. Instead of sending in a leaf sample to a lab for diagnosis, farmers could upload an image of the diseased leaf for analysis.

The researchers are currently developing more robust prototypes of the CellScope in preparation for further field testing.

Other researchers on the team include Robi Maamari, a UC Berkeley research associate in bioengineering and co-lead author of the study; Neil Switz, a graduate student in UC Berkeley's Biophysics Graduate Group; and Wilbur Lam, a UC Berkeley post-doctoral fellow in bioengineering and a UCSF pediatric hematologist.

Doctors missing consciousness in vegetative patients

* 12:47 21 July 2009 **by Celeste Biever**

If there's one thing worse than being in a coma, it's people thinking you are in one when you aren't. Yet a new comparison of methods for detecting consciousness suggests that around 40 per cent of people diagnosed as being in a vegetative state are in fact "minimally conscious".

In the worst case scenario, such misdiagnoses could influence the decision to allow a patient to die, even though they have some vestiges of consciousness. But crucially it may deprive patients of treatments to make them more comfortable, more likely to recover, or to allow them to communicate with family, say researchers.

In a vegetative state (VS), reflexes are intact and the patient can breathe unaided, but there is no awareness. A minimally conscious state (MCS) is a sort of twilight zone, only recently recognised, in which people may feel some physical pain, experience some emotion, and communicate to some extent. However, because consciousness is intermittent and incomplete in MCS, it can be sometimes very difficult to tell the difference between the two.

In 2002 Joseph Giacino at the JFK Rehabilitation Institute in New Jersey and colleagues released the first diagnostic criteria for MCS. Then in 2004, Giacino released a revised coma recovery scale (CRS-R) – a series of behavioural tests based on criteria that can be used to distinguish between the two states.

Alarm 'appropriate'

To see if the revised scale improves diagnoses, Giacino and Caroline Schnakers of the Coma Science Group at the University of Liege in Belgium, with colleagues, spent two years using CRS-R to re-diagnose patients admitted to a network of Belgian intensive care units and neurology clinics with head injuries that resulted in some kind of disturbance to consciousness.

The clinics and units all used a "clinical consensus" agreed by a range of specialists to diagnose patients. Some of the specialists relied on qualitative, "bedside" observations to diagnose patients, others used older diagnostic tools, but none used the CRS-R – the only one designed specifically to distinguish between MCS and VS.

Of the 44 patients diagnosed as being in a vegetative state by the clinicians, the researchers diagnosed 18, or 41 per cent, as being in a MCS according to the CRS-R.

"We may have become much too comfortable about our ability to detect consciousness," concludes Giacino. "I think it's appropriate for there to be some level of alarm about this."

Giacino concedes that, because there is no objective way to measure consciousness, he cannot exclude the possibility that the reason for the discrepancy is that the CRS-R is over-diagnosing MCS.

Examiner bias

However, Schnakers argues that CRS-R should be more accurate because it specifies how many times each test must be repeated – and how many responses are needed to give an indication of consciousness.

This, she says, guards against missing awareness in someone who pops in and out of consciousness, or mistaking a reflexive response for a response based on consciousness. It should also control for "examiner bias", where someone subjectively decides whether the patient is conscious or not, adds Giacino.

What's more, the revised scale also makes use of some new insights. One sign of consciousness is whether someone follows the path of a moving object, known as "visual pursuit". Many clinicians simply look at whether someone follows a moving pen or person, says Schnakers.

The CRS-R specifies the use of a mirror, which she argues may prompt a reaction in someone who is conscious, but who does not respond to a moving pen. "When you move an object, it is less powerful," she says.

'Death or survival'

So why do clinicians still use the qualitative assessment? "Their focus is more typically on death or survival" and on biological factors that need treatment, such as how long a patient needs to be in an intensive care unit, says John Whyte of the Moss Rehabilitation Research Institute in Philadelphia, Pennsylvania, who was not involved in the study. "For their purposes, the distinction [between MCS and VS] doesn't matter much."

For the patient and the family, the difference between MCS and VS can make a huge difference, though. Drug treatments, painkillers, physical therapies designed to stimulate the brain, as well as techniques for encouraging communication, are more likely to be given to someone in a MCS.

In some jurisdictions, whether food can be withdrawn may depend on whether or not they are in a VS, says Whyte. "It's very important to be sure of the diagnosis," says Schnakers.

Journal reference: BMC Neurology (DOI: 10.1186/1471-2377-9-35)

Ovary removal may increase lung cancer risk

New study published in the International Journal of Cancer

Montreal, July 21, 2009 – Women who have premature menopause because of medical interventions are at an increased risk of developing lung cancer, according to a new study published in the *International Journal of Cancer*. The startling link was made by epidemiologists from the Université de Montréal, the Research Centre of the Centre Hospitalier de l'Université de Montréal and the INRS—Institut Armand-Frappier.

"We found that women who experienced non-natural menopause are at almost twice the risk of developing lung cancer compared to women who experienced natural menopause," says Anita Koushik, a researcher at the Université de Montréal's Department of Social and Preventive Medicine and a scientist at the Research Centre of the Centre Hospitalier de l'Université de Montréal. "This increased risk of lung cancer was particularly observed among women who had non-natural menopause by having had both their ovaries surgically removed."

The scientists studied 422 women with lung cancer and 577 control subjects at 18 hospitals across Montreal, Quebec, Canada. They assessed socio-demographic characteristics, residential history, occupational exposures, medical and smoking history, and (among women) menstruation and pregnancy histories.

"A major strength of this study was the detailed smoking information which we obtained from all study participants; this is important because of the role of smoking in lung cancer and because smokers generally have lower estrogen levels than non-smokers," says Dr. Koushik. "Although smoking is the dominant cause of lung cancer, we know other factors can play an important role in enhancing the impact of tobacco carcinogens; this research suggests that in women hormonal factors may play such a role."

Women were considered menopausal if their menstrual periods had stopped naturally, surgically (by hysterectomy with bilateral surgical ovary removal) or because of radiation or chemotherapy. Women who had at least one remaining ovary and who still had their menstrual periods at the time of diagnosis/interview were classified as premenopausal. Among participants with natural menopause, the median age for attaining menopause was 50 years old; among those with non-natural menopause, it was at 43 years.

"Non-natural menopause, particularly surgical menopause, may represent an increased risk with younger age at menopause given that surgery is usually done before natural menopause occurs. It's possible that vulnerability to lung cancer is caused by early and sudden decrease in estrogen levels or potentially long-term use of hormone replacement therapy and further research is needed to explore these hypotheses," says Jack Siemiatycki a professor at the Université de Montréal's Department of Social and Preventive Medicine and a scientist at the Research Centre of the Centre Hospitalier de l'Université de Montréal.

About the Study: The article "Characteristics of menstruation and pregnancy and the risk of lung cancer in women," published in the *International Journal of Cancer*, was authored by Anita Koushik and Jack Siemiatycki of the Université de Montréal and Research Centre of the Centre Hospitalier de l'Université de Montréal and Marie-Elise Parent of the INRS—Institut Armand-Frappier.

Partners in Research: This study was funded by the Canadian Institutes of Health Research, the Fonds de la recherche en santé du Québec and the Guzzo-SRC Chair in Environment and Cancer.

On the Web: About cited article from *International Journal of Cancer*: <http://www3.interscience.wiley.com/cgi-bin/fulltext/122380525/PDFSTART>

This article will self-destruct: A tool to make online personal data vanish

Hannah Hickey hickeyh@u.washington.edu

Computers have made it virtually impossible to leave the past behind. College Facebook posts or pictures can resurface during a job interview. A lost cell phone can expose personal photos or text messages. A legal investigation can subpoena the entire contents of a home or work computer, uncovering incriminating, inconvenient or just embarrassing details from the past.

The University of Washington has developed a way to make such information expire. After a set time period, electronic communications such as e-mail, Facebook posts and chat messages would automatically self-destruct, becoming irretrievable from all Web sites, inboxes, outboxes, backup sites and home computers. Not even the sender could retrieve them.

"If you care about privacy, the Internet today is a very scary place," said UW computer scientist Tadayoshi Kohno. "If people understood the implications of where and how their e-mail is stored, they might be more careful or not use it as often."

The team of UW computer scientists developed a prototype system called Vanish that can place a time limit on text uploaded to any Web service through a Web browser. After a set time text written using Vanish will, in essence, self-destruct. A paper about the project went public today and will be presented at the Usenix Security Symposium Aug. 10-14 in Montreal. The paper and research prototype are at <http://vanish.cs.washington.edu>.

Co-authors on the paper are doctoral student Roxana Geambasu, assistant professor Tadayoshi Kohno, professor Hank Levy and undergraduate student Amit Levy, all with the UW's department of computer science and engineering. The research was funded by the National Science Foundation, the Alfred P. Sloan Foundation and Intel Corp.

"When you send out a sensitive e-mail to a few friends you have no idea where that e-mail is going to end up," Geambasu said. "For instance, your friend could lose her laptop or cell phone, her data could be exposed by malware or a hacker, or a subpoena could require your e-mail service to reveal your messages. If you want to ensure that your message never gets out, how do you do that?"

Many people believe that pressing the "delete" button will make their data go away. "The reality is that many Web services archive data indefinitely, well after you've pressed delete," Geambasu said.

Simply encrypting the data can be risky in the long term, the researchers say. The data can be exposed years later, for example, by legal actions that force an individual or company to reveal the encryption key. Current trends in the computing and legal landscapes are making the problem more widespread.

"In today's world, private information is scattered all over the Internet, and we can't control the lifetime of that data," said Hank Levy. "And as we transition to a future based on cloud computing, where enormous, anonymous datacenters run the vast majority of our applications and store nearly all of our data, we will lose even more control."

The Vanish prototype washes away data using the natural turnover, called "churn," on large file-sharing systems known as peer-to-peer networks. For each message that it sends, Vanish creates a secret key, which it never reveals to the user, and then encrypts the message with that key. It then divides the key into dozens of pieces and sprinkles those pieces on random computers that belong to worldwide file-sharing networks, the same ones often used to share music or movie files. The file-sharing system constantly changes as computers join or leave the network, meaning that over time parts of the key become permanently inaccessible. Once enough key parts are lost, the original message can no longer be deciphered.

In the current Vanish prototype, the network's computers purge their memories every eight hours. (An option on Vanish lets users keep their data for any multiple of eight hours.)

Unlike existing commercial encryption services, a message sent using Vanish is kept private by an inherent property of the decentralized file-sharing networks it uses. "A major advantage of Vanish is that users don't need to trust us, or any service that we provide, to protect or delete the data," Geambasu says.

Researchers liken using Vanish to writing a message in the sand at low tide, where it can be read for only a few hours before the tide comes in and permanently washes it away. Erasing the data doesn't require any special action by the sender, the recipient or any third party service. "Our goal was really to come up with a system where, through a property of nature, the message, or the data, disappears," Hank Levy says.

Vanish was released today as a free, open-source tool that works with the Firefox browser. To work, both the sender and the recipient must have installed the tool. The sender then highlights any sensitive text entered into the browser and presses the "Vanish" button. The tool encrypts the information with a key unknown even to the sender. That text can be read, for a limited time only, when the recipient highlights the text and presses the "Vanish" button to unscramble it. After eight hours the message will be impossible to unscramble and will remain gibberish forever.

Vanish works with any text entered into a Web browser: Web-based e-mail such as Hotmail, Yahoo and Gmail, Web chat, or the social networking sites MySpace and Facebook. The Vanish prototype now works only for text, but researchers said the same technique could work for any type of data, such as digital photos.

It is technically possible to save information sent with Vanish. A recipient could print e-mail and save it, or cut and paste unencrypted text into a word-processing document, or photograph an unscrambled message. Vanish is meant to protect communication between two trusted parties, researchers say.

"Today many people pick up the phone when they want to talk with a lawyer or have a private conversation," Kohno said. "But more and more communication is happening online. Vanish is designed to give people the same privacy for e-mail and the Web that they expect for a phone conversation."

For more information, contact Geambasu at 206-685-1963 or roxana@cs.washington.edu, Hank Levy at 206-543-9204 or levy@cs.washington.edu, and Kohno at 206-331-0840 or yoshi@cs.washington.edu. On Tuesday and Wednesday Kohno will be in Boston and best reached via e-mail.

Mayo Clinic researchers find first potential pathogenic mutation for restless legs syndrome

JACKSONVILLE, Fla. - An international team of researchers led by scientists at the Mayo Clinic campus in Florida have found what they believe is the first mutated gene linked to restless legs syndrome, a common neurologic disorder.

The researchers, who reported the findings in the July 21 issue of *Neurology*, doubt that a large proportion of the millions of people who suffer from the syndrome have this mutated MEIS1 gene. They point out, however, that understanding the function of both the normal and abnormal genes will shed some insights into this mysterious disorder.

Restless legs syndrome affects between 5 and 11 percent of the population in Europe and in North America. The condition is characterized by unpleasant sensations in the legs at rest, especially in the evening, that are temporarily relieved by movement. Because restless legs syndrome often interrupts sleep, people commonly are diagnosed after they consult a sleep specialist for assistance.

"We think restless legs syndrome may be due to a number of clinical factors, but we also believe that there is a strong genetic component to the disorder," says the study's lead investigator, Carles Vilariño-Güell, Ph.D., a neuroscientist at Mayo Clinic, Jacksonville.

"The mutation we found is in a portion of the protein that is identical in species as distinct to human as frogs and fish, which tells us that this portion is very important for the proper function of the protein and that the mutation has a very high chance of causing disease," he says.

While common variants (different versions) of MEIS1 and BTBD9, another associated gene, have been found in families with a high incidence of restless legs syndrome, it is not clear that those variants are capable of causing disease, Dr. Vilariño-Güell says.

"This mutation, on the other hand, is the first that we think can be a real candidate for causing or promoting restless legs syndrome," he says.

Researchers did not find mutations in the BTBD9 gene in study participants, but they found one in the MEIS1 gene that resulted in the production of an aberrant protein. The family that has the MEIS1 mutation consists of six members. Three who had restless legs syndrome had the mutation and the other three without the disease did not. "The presence of the mutation in all affected individuals supports a pathogenic role for the MEIS1 gene, and we now need to confirm this finding with other international research groups who study restless legs syndrome," Dr. Vilariño-Güell says.

Researchers from Canada, Ireland, and Norway also participated in the study. In total 378 restless legs syndrome patients and 853 healthy participants were evaluated for the presence of this newly discovered mutation in their DNA. This analysis only identified one additional individual from Ireland who did not present any symptoms of restless legs syndrome. This suggests that the gene defect may need additional triggers to develop the syndrome, Dr. Vilariño-Güell says. "This gene is probably not the most common cause of restless legs syndrome in the population we studied, but it may be more prevalent in other regions of the world," he says. *The study was funded by the National Institutes of Health, and a research grant from Mayo Clinic.*

Daily potassium citrate wards off kidney stones in seizure patients on high-fat diet

Children on the high-fat ketogenic diet to control epileptic seizures can prevent the excruciatingly painful kidney stones that the diet can sometimes cause if they take a daily supplement of potassium citrate the day they start the diet, according to research from Johns Hopkins Children's Center.

A report on the work is published in the August issue of *Pediatrics*.

"We can confidently say this is a safe and powerful way to prevent kidney stones, and it should become part of standard therapy in all ketogenic dieters, not just those who already show elevated urine calcium levels," says senior investigator Eric Kossoff, M.D., a pediatric neurologist at Hopkins Children's. "If you wait, it might be too late."

The ketogenic diet, believed to work by initiating biochemical changes that eliminate seizure-triggering short circuits in the brain's signaling system, is given to many children whose seizures do not respond to medications. But the diet, which consists of high-fat foods with very few carbohydrates, causes a buildup of calcium in the urine and the formation of kidney stones in about 6 percent of those on it.

Hopkins Children's adopted the preventive treatment with potassium citrate two years ago, and doctors now believe this one major side effect of the diet is a thing of the past, allowing more children to remain on the diet for longer. Potassium citrate taken twice daily, either as powder sprinkled on food or dissolved in water, is believed to inhibit stone formation.

In their study of 301 children treated for epilepsy with the ketogenic diet at Hopkins Children's the researchers found that those who got potassium citrate twice daily were seven times less likely to develop kidney stones - one of 106 (0.9 percent) developed a kidney stone compared to 13 out of 195 (6.7 percent) who were given potassium citrate only after testing positive for elevated levels of blood calcium. Most children received one 30-milliequivalent packet (about 1,170 milligrams or 0.04 ounces) of potassium citrate twice daily.

Although rarely serious, kidney stones can cause significant pain, along with kidney and urinary tract infections, and may require surgery.

The research was funded in part by the NIH and the Carson Harris Foundation.

Co-investigators include: Melanie McNally, B.S.; Paula Pyzik, B.S.; James Rubenstein, M.D.; Rana Hamdy, M.D. M.P.H.

New evidence: AIDS-like disease in wild chimpanzees

Groundbreaking study from international research team includes University of Illinois and Lincoln Park Zoo scientists

Chicago – An international consortium has found that wild chimpanzees naturally infected with Simian Immunodeficiency Viruses (SIV) – long thought to be harmless to the apes – can contract an AIDS-like syndrome and die as a result. The findings are published in the July 23 edition of the journal *Nature*.

Scientists have known that the AIDS virus, HIV-1, first entered the human population after transmission from chimpanzees. The precursor virus, SIV, has many different forms, most of which infect various African monkey species. While there are data for only a few of these species, all of the evidence so far has indicated that monkey SIVs are not pathogenic in their natural hosts.

"We all assumed that the same was true of SIV infection in chimpanzees, but that turns out not to be the case," said Dr. Beatrice Hahn, a professor of medicine at the University of Alabama at Birmingham, who led the investigation. "But of course chimps are not monkeys. Chimpanzees and humans are very similar genetically, so perhaps we should not be surprised that these closely related viruses cause disease in both hosts."

The study focused on chimpanzees at Gombe National Park, on the shores of Lake Tanganyika in Tanzania. For nearly 50 years, primatologist Jane Goodall and her colleagues have studied the chimpanzee communities at Gombe, monitoring their biology and behavior.

Lincoln Park Zoo and University of Illinois researchers, in cooperation with the Jane Goodall Institute (JGI) and Tanzania National Parks (TANAPA), established a chimpanzee health-monitoring program at Gombe. This program provided the necessary field laboratories and veterinary expertise to enable post-mortem analyses of chimpanzees that died during the course of the study.

"We are pleased to see the groundbreaking results coming out of the multidisciplinary epidemiological health monitoring system we've established in Gombe," said veterinary epidemiologist Dominic Travis, vice

president of conservation and science at Lincoln Park Zoo and an author on the study. "This has significance for Gombe chimp health and park management, disease ecology as it relates to retroviral emergence, and to ape conservation as a whole by using Gombe as a laboratory. This field site is once again a model of how long-term scientific studies can inform us in many ways."

For the last nine years, the consortium has been monitoring the SIV infection status of the Gombe chimpanzees. It was possible to determine from fecal samples which individuals were infected at the start of the study, and which became infected during the study. At any one time during this period, between 10 and 20 percent of chimpanzees were SIV-positive. Statistical death hazard analyses, taking into account factors such as an individual's age and sex, indicated that those chimpanzees infected with SIV were 10 to 16 times more likely to die in any year than those who remained uninfected.

According to anthropology professor Jamie Holland Jones of Stanford University, who performed the analyses, "at this point we cannot be too precise about the magnitude of the effect, because the number of chimpanzees surveyed is still limited. Nevertheless, the evidence is clear that infected apes have lower survival rates."

The consortium also found that infected females were significantly less likely to give birth, and that any infants born to infected mothers had a low chance of survival.

Additional evidence came from necropsies performed by veterinary pathologists from the University of Illinois Zoological Pathology Program. A hallmark of HIV-1 infection in humans is the loss of CD4+ T-cells; these cells are a vital component of the immune system, and their depletion renders patients susceptible to many other infections – the classic symptoms of AIDS.

"When I first looked at these samples I was taken aback," said University of Illinois veterinary pathologist Karen Terio, a primary author on the paper. "Slides from one of the chimps showed extreme lymphatic tissue destruction, and looked just like a sample from a human patient who has died of AIDS."

Analysis by Jake Estes, an investigator at the National Cancer Institute and a primary author on the paper, confirmed a link between SIV infection and CD4+ T-cell decline in the chimpanzees.

Although this study was limited to chimpanzees at Gombe, SIV infection is widespread across two subspecies, central and eastern chimpanzees, which range from Cameroon in west central Africa to Tanzania in the east. (Two other subspecies, western and Nigerian chimpanzees, do not appear to have SIV infections.)

"Previously, we didn't think SIV could affect chimpanzee population health. Now we know it's possible," said primatologist Elizabeth Lonsdorf from Lincoln Park Zoo, a co-primary investigator of the zoo-led health monitoring initiative. "The next step is to understand this issue better in Gombe to see if it is site-specific, or if it has potential widespread implications for chimpanzee conservation."

The finding that SIV causes disease in chimpanzees opens up a number of new avenues of research.

The international consortium comprises researchers from Gombe Stream Research Centre, The Jane Goodall Institute, Lincoln Park Zoo, National Cancer Institute, Stanford University, Tanzania National Parks, University of Alabama at Birmingham, University of Edinburgh, University of Illinois, University of Minnesota, University of Pennsylvania and Yerkes National Primate Research Centre.

Ytterbium's Broken Symmetry

Posted By paulpreuss On July 22, 2009 @ 8:26 am In Feature Stories

Of the four fundamental interactions, the weak force has the shortest range and does some of the most peculiar things, like changing the flavor of quarks, governing the interactions of neutrinos, and violating parity—nature's mirror symmetry. Recent measurements of ytterbium have yielded the largest parity violations ever observed in an atom.

Ytterbium was discovered in 1878, but until it recently became useful in atomic clocks, the soft metal rarely made the news. Now ytterbium has a new claim to scientific fame. Measurements with ytterbium-174, an isotope with 70 protons and 104 neutrons, have shown the largest effects of parity violation in an atom ever observed – a hundred times larger than the most precise measurements made so far, with the element cesium.

"Parity" assumes that, on the atomic scale, nature behaves identically when left and right are reversed: interactions that are otherwise the same but whose spatial configurations are switched, as if seen in a mirror, ought to be indistinguishable. Sounds like common sense but, remarkably, this isn't always the case.

"It's the weak force that allows parity violation," says Dmitry Budker, who led the research team. Budker is a member of the Nuclear Science Division at the U.S. Department of Energy's Lawrence Berkeley National Laboratory and a professor of physics at the University of California at Berkeley.

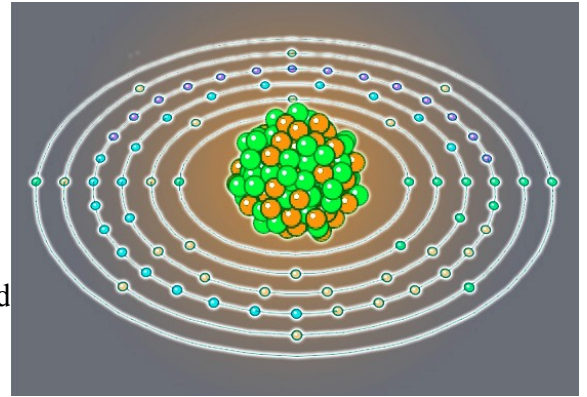
Of the four forces of nature – strong, electromagnetic, weak, and gravitational – the extremely short-range weak force was the last to be discovered. Neutrinos, having no electric charge, are immune to electromagnetism and only interact through the weak force. The weak force also has the startling ability to change the flavor of quarks, and to change protons into neutrons and vice versa.

Violating parity – neutrons and the weak force

Protons on their own last forever, apparently, but a free neutron falls apart in about 15 minutes; it turns into a proton by emitting an electron and an antineutrino, a process called beta decay. What makes beta decay possible is the weak force.

Scientists long assumed that nature, on the atomic scale, was symmetrical. It would look the same not only if left and right were reversed but also if the electrical charges of particles involved in an interaction were reversed, or even if the whole process ran backwards in time. Charge conjugation is written C, parity P, and time T; nature was thought to be C invariant, P invariant, and T invariant.

In 1957 researchers realized that the weak force didn't play by the rules. When certain kinds of nuclei such as cobalt-60 are placed in a magnetic field to polarize them – line them up – and then allowed to undergo beta decay, they are more likely to emit electrons from their south poles than from their north poles.



The most common isotope of ytterbium has 70 protons and 104 neutrons in the nucleus.

This was the first demonstration of parity violation. Before the 1957 cobalt-60 experiment, renowned physicist Richard Feynman had said that if P violation were true – which he doubted – something long thought impossible would be possible after all: “There would be a way to distinguish right from left.” It's now apparent that many atoms exhibit parity violation, although it is not easy to detect. P violation has been measured with the greatest accuracy in cesium atoms, which have 55 protons and 78 neutrons in the nucleus, by using optical methods to observe the effect when atomic electrons are excited to higher energy levels.

An atomic beam of ytterbium is generated in the oven at left, then passed through a chamber with magnetic and electric fields arranged at right angles—the magnetic field colinear with the atomic beam, and the electric field colinear with a laser beam that excites a “forbidden” electron-energy transition. Weak interactions between electron and nucleus contribute to the forbidden transition. (Click on image for best resolution.)

The Berkeley researchers designed their own apparatus to detect the much larger parity violation predicted for ytterbium. In their experiment, ytterbium metal is heated to 500 degrees Celsius to produce a beam of atoms, which is sent through a chamber where magnetic and electric fields are oriented at right angles to each other. Inside the chamber the ytterbium atoms are hit by a laser beam, tuned to excite some of their electrons to higher energy states via a “forbidden” (highly unlikely) transition. The electrons then relax to lower energies along different pathways.

Weak interactions between the electron and the nucleus – plus weak interactions within the nucleus of the atom – act to mix some of the electron energy states together, making a small contribution to the forbidden transition. But other, more ordinary electromagnetic processes, which involve apparatus imperfections, also mix the states and blur the signal. The purpose of the chamber's magnetic and electric fields is to amplify the parity-violation effect and to remove or identify these spurious electromagnetic effects.

Upon analyzing their data, the researchers found a clear signal for atomic parity violations, 100 times larger than the similar signal for cesium. With refinements to their experiment, the strength and clarity of the ytterbium signal promise significant advances in the study of weak forces in the nucleus.

Watching the weak force at work

The Budker group's experiments are expected to expose how the weak charge changes in different isotopes of ytterbium, whose nuclei have the same number of protons but different numbers of neutrons, and will reveal how weak currents flow within these nuclei.

The results will also help explain how the neutrons in the nuclei of heavy atoms are distributed, including whether a “skin” of neutrons surrounds the protons in the center, as suggested by many nuclear models.

“The neutron skin is very hard to detect with charged probes, such as by electron scattering,” says Budker, “because the protons with their large electric charge dominate the interaction.”

He adds, “At a small level, the measured atomic parity violation effect depends on how the neutrons are distributed within the nucleus – specifically, their mean square radius. The mean square radius of the protons is well known, but this will be the first evidence of its kind for neutron distribution.”

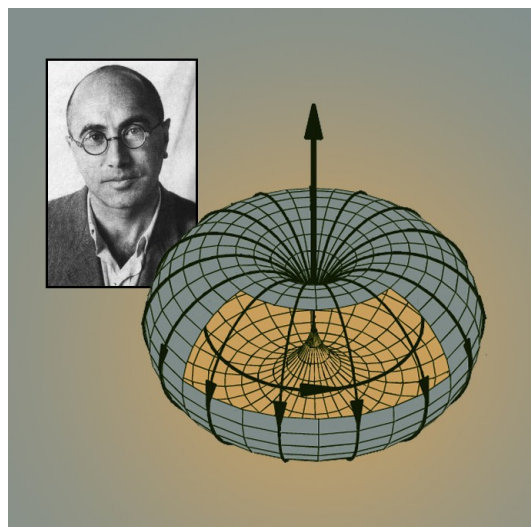
Measurements of parity violation in ytterbium may also reveal “anapole moments” in the outer shell of neutrons in the nucleus (valence neutrons). As predicted by the Russian physicist Yakov Zel'dovich, these electric currents are induced by the weak interaction and circulate within the nucleus like the currents inside the

toroidal winding of a tokamak; they have been observed in the valence protons of cesium but not yet in valence neutrons.

Eventually the experiments will lead to sensitive tests of the Standard Model – the theory that, although known to be incomplete, still best describes the interactions of all the subatomic particles so far observed.

“So far, the most precise data about the Standard Model has come from high-energy colliders,” says Budker. “The carriers of the weak force, the W and Z bosons, were discovered at CERN by colliding protons and antiprotons, a ‘high-momentum-transfer’ regime. Atomic parity violation tests of the Standard Model are very different – they’re in the low-momentum-transfer regime and are complementary to high-energy tests.”

Since 1957, when Zel’dovich first suggested seeking atomic variation in atoms by optical means, researchers have come ever closer to learning how the weak force works in atoms. Parity violation has been detected in many atoms, and its predicted effects, such as anapole moments in the valence protons of cesium, have been seen with ever-increasing clarity. With their new experimental techniques and the observation of a large atomic parity violation in ytterbium, Dmitry Budker and his colleagues have achieved a new landmark, moving closer to fundamental revelations about our asymmetric universe on the atomic scale.



Yacov Zel'dovich proposed that the weak force induces electrical currents in the nucleus, which flow like currents in a tokamak. This anapole moment has been detected in nuclear valence protons but not yet in valence neutrons.

“Observation of a large atomic parity violation in ytterbium,” by K. Tsigutkin, D. Dounas-Frazer, A. Family, J. E. Stalnaker, V. V. Yashchuk, and D. Budker, appears in *Physical Review Letters* and is available online at [6] <http://arxiv.org/abs/0906.3039>.

Ion engine could one day power 39-day trips to Mars

* Updated 17:50 23 July 2009 by Lisa Grossman

There's a growing chorus of calls to send astronauts to Mars rather than the moon, but critics point out that such trips would be long and gruelling, taking about six months to reach the Red Planet. But now, researchers are testing a powerful new ion engine that could one day shorten the journey to just 39 days.

Traditional rockets burn chemical fuel to produce thrust. Most of that fuel is used up in the initial push off the Earth's surface, so the rockets tend to coast most of the time they're in space.



The VASIMR ion engine could - if powered by an onboard nuclear reactor - take astronauts to Mars in just 39 days
(Illustration: Ad Astra Rocket Company)

Ion engines, on the other hand, accelerate electrically charged atoms, or ions, through an electric field, thereby pushing the spacecraft in the opposite direction. They provide much less thrust at a given moment than do chemical rockets, which means they can't break free of the Earth's gravity on their own.

But once in space, they can give a continuous push for years, like a steady breeze at the back of a sailboat, accelerating gradually until they're moving faster than chemical rockets.

Several space missions have already used ion engines, including NASA's Dawn spacecraft, which is en route to the asteroids Vesta and Ceres, and Japan's spacecraft Hayabusa, which rendezvoused with the asteroid Itokawa in 2005.

But a new engine, called VASIMR (Variable Specific Impulse Magnetoplasma Rocket), will have much more "oomph" than previous ones. That's because it uses a radio frequency generator, similar to transmitters used to broadcast radio shows, to heat the charged particles, or plasma.

The engine is being developed by the Ad Astra Rocket Company, which was founded in 2005 by plasma physicist and former space shuttle astronaut Franklin Chang-Diaz.

As hot as the sun

VASIMR works something like a steam engine, with the first stage performing a duty analogous to boiling water to create steam. The radio frequency generator heats a gas of argon atoms until electrons "boil" off, creating plasma. This stage was tested for the first time on 2 July at Ad Astra's headquarters in Webster, Texas.

The plasma could produce thrust on its own if it were shot out of the rocket, but not very efficiently. To optimise efficiency, the rocket's second stage then heats the ions to about a million degrees, a temperature comparable to that at the centre of the sun.

It does this by taking advantage of the fact that in a strong magnetic field – like those produced by superconducting magnets in the engine, ions spin at a fixed frequency. The radio frequency generator is then tuned to that same frequency, injecting extra energy into the ions.

High power

Strong magnetic fields then channel the plasma out the back of the engine, propelling the rocket in the opposite direction.

Thanks to the radio frequency generator, VASIMR can reach power levels a hundred times as high as other engines, which simply accelerate their plasma by sending it through a series of metal grids with different voltages. In that setup, ions colliding with the grid tend to erode it, limiting the power and lifetime of the rocket. VASIMR's radio frequency generator gets around that problem by never coming into contact with the ions.

"It's the most powerful superconducting plasma source ever, as far as we know," says Jared Squire, director of research at Ad Astra.

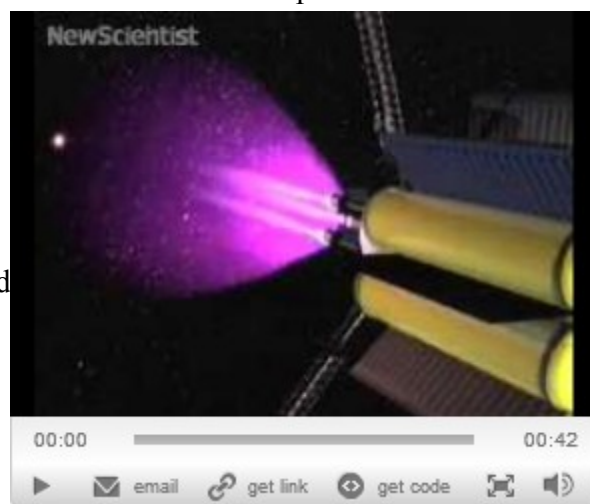
Scientists at Ad Astra began tests of the engine's second stage – which heats the plasma – last week. So far, team members have run the two-stage engine at a power of 50 kilowatts. But they hope to ramp up to 200 kW of power in ongoing tests, enough to provide about a pound of thrust. That may not sound like much, but in space it can propel up to two tonnes of cargo, reaching Jupiter in about 19 months from a starting position relatively close to the sun, says Squire.

Orbital boosts

Ad Astra and NASA have agreed to test fire the rocket in space, attached to the International Space Station in 2012 or 2013. Potentially, VASIMR could provide the periodic boosts needed to keep the ISS in its orbit.

At its current power level, VASIMR could be run entirely on solar energy. Squire says it would make a good Earth-orbit tugboat, pulling satellites to different orbits. It could also shuttle cargo to a lunar base, and because it could travel relatively quickly, it could be deployed to dangerous asteroids to gravitationally nudge them off course years before they would reach Earth.

To travel to Mars in 39 days, however, the engine would need 1000 times more power than solar energy could provide. For that, VASIMR would need an onboard nuclear reactor. Early versions of the reactor technology were used from the 1960s to the 1980s by the Soviet Union, but have not been used in space since and would take time to develop. "That would be quite a ways down the line," Squire says.



[Video: See the rocket in action](#)

'Game changer'

But the possibility of such a short trip to Mars was recently lauded by Charles Bolden, NASA's new chief. He said NASA had provided a small stipend towards VASIMR's development, and said the collaboration was a good example of a partnership with private industry that could help the agency meet its goals after the space shuttles are retired in 2010.

John Muratore of the University of Tennessee Space Institute and a former lead engineer for NASA's space shuttle programme, says engines like VASIMR could enable the first human trips to Mars.

"The bottom line is with the current propulsion technology, Mars missions are undoable for humans," he says, explaining that such long trips outside of the Earth's protective magnetic field would expose astronauts to greater amounts of dangerous space radiation.

If engines, such as VASIMR, could be developed to take people to the Red Planet in 40 days, "that puts it inside the range of what we feel comfortable of doing with humans," he told New Scientist. "Something like VASIMR – that's a game changer."

Stem cells not the only way to fix a broken heart

Researchers appear to have a new way to fix a broken heart. They have devised a method to coax heart muscle cells into reentering the cell cycle, allowing the differentiated adult cells to divide and regenerate healthy heart tissue after a heart attack, according to studies in mice and rats reported in the July 24th issue of the journal *Cell*, a Cell Press publication. The key ingredient is a growth factor known as neuregulin1 (NRG1 for short), and the researchers suggest that the factor might one day be used to treat failing human hearts.

"To my knowledge, this is the first regenerative therapy that may be applicable in a systemic way," said Bernhard Kühn of Children's Hospital Boston and Harvard Medical School. For instance, he added, people

might one day go to the clinic for daily infusions of NRG1 over a period of weeks. "In principle, there is nothing to preclude this going into the clinic. Based on all the information we have, this is a promising candidate." He emphasized, however, that further studies would be required to demonstrate safety before such treatment could be tested in human patients.

The heart had long been considered an organ largely incapable of repairing itself. Heart muscle cells, also known as cardiomyocytes, do proliferate during prenatal development. Soon after birth, however, the cells become binucleated, meaning that they have two nuclei, and withdraw from the cell cycle, giving rise to the notion that adult cardiomyocytes are terminally differentiated and incapable of further proliferation.

However, recent evidence has shown that adult heart muscle cells can replace themselves at some low level, with perhaps half of the cells in the heart turning over in the course of a lifetime, Kühn said. The new study provides multiple lines of evidence for this turnover ability - including video of the cells in action - and shows that neuregulin1 can ramp up the process.

In the current study, the researchers first tested the ability of various molecules to spur cell division in cultured cardiomyocytes. If cardiomyocytes are to reenter the cell cycle along the border zone of injury, the researchers surmised that there must be an extracellular signal that triggers the response, Kühn explained.

They looked to several factors known to drive cardiomyocyte proliferation during prenatal development. Of those, NRG1 had the most significant effect, inducing the division of those cardiomyocytes with one nucleus instead of two.

By manipulating the NRG1 receptor up or down, the researchers showed they could increase or decrease cardiomyocyte proliferation in living animals. Moreover, injecting NRG1 in adult mice sparked cardiomyocyte cell-cycle activity and promoted the regeneration of heart muscle, leading to improved function after the animals suffered a heart attack. That regeneration could not be traced to undifferentiated progenitor cells, they report.

The researchers say they aren't sure whether NRG1 is responsible for the natural repair process, but their findings show that it clearly can enhance it. They also note that the NRG1 receptor and NRG1 itself are always present in the adult heart, though it is not clear if they are in the right place or in sufficient quantities.

"Collectively, we have identified the major elements of a new approach to promote myocardial regeneration," the researchers wrote. "Many efforts and important advances have been made toward the goal of developing stem-cell based strategies to regenerate damaged tissues in the heart as well as in other organs. The work presented here suggests that stimulating differentiated cardiomyocytes to proliferate may be a viable alternative that could be developed into a simple strategy to promote myocardial regeneration in mammals."

Before making the leap to the clinic, Kühn's group intends to further explore how the treatment works at the fundamental level. They will also characterize the regenerative response in pigs, which have more in common with humans than rodents do, before testing the approach in human patients. Ultimately, such a treatment might serve as a useful alternative or complement to treatments designed to seed damaged hearts with regenerative stem cells, Kühn said.

The researchers include Kevin Bersell, Children's Hospital, Boston, MA; Shima Arab, Children's Hospital, Boston, MA; Bernhard Haring, Children's Hospital, Boston, MA, Harvard Medical School, Boston, MA; and Bernhard Kühn, Children's Hospital, Boston, MA, Harvard Medical School, Boston, MA.

Mass. General team develops potentially safer general anesthetic

Animal studies verify that new intravenous agent maintains blood pressure, avoids prolonged adrenal suppression

A team of Massachusetts General Hospital (MGH) physicians has developed a new general anesthetic that may be safer for critically ill patients. In the August issue of *Anesthesiology*, they describe preclinical studies of the drug called MOC-etomidate – a chemically altered version of an existing anesthetic – which does not cause the sudden drop in blood pressure seen with most anesthetics or prolonged suppression of adrenal gland activity, a problem with the original version of the drug.

"We have shown that making a version of etomidate that is broken down very quickly in the body reduces the duration of adrenal suppression while retaining etomidate's benefit of keeping blood pressure much more stable than other anesthetics do," says Douglas Raines, MD, of the MGH Department of Anesthesia, Critical Care and Pain Medicine, who led the study.

Almost all general anesthetic agents reduce blood pressure immediately after they are administered, which is not a problem for young and healthy patients but can have serious consequences for those who are elderly, critically ill or suffering from blood loss. For such patients, etomidate is often used to induce anesthesia, but since adrenal suppression sets in quickly and can last for several hours to days, other agents are used to

maintain anesthesia during a procedure, requiring very careful monitoring to avoid dangerous blood pressure drops.

In their search for a safer version of etomidate, the research team mimicked the chemical structure of other "soft analogue" drugs – derivatives of parent drugs designed to be rapidly metabolized – by adding a molecule that causes the drug to be broken down by natural enzymes soon after producing its effects. Experiments in tadpoles and rats showed that the new agent, MOC-etomidate, quickly produced anesthesia from which the animals recovered rapidly after administration ceased. The rat study verified that MOC-etomidate had little effect on blood pressure levels and no effect on adrenal activity, even when administered at twice the dosage required to produce anesthesia.

The researchers note that, since the study only examined the effect of a single dose of MOC-etomidate, their next step will be to study continuous infusion of the drug. Additional data must be gathered from animal studies before testing the agent in human patients is feasible. "If all goes well, we expect that we could give a large dose of MOC-etomidate to induce anesthesia and then run a continuous infusion to maintain anesthesia without reducing blood pressure in even very sick patients," Raines says. "We also anticipate that patients will wake more quickly and with less sedation after surgery and anesthesia."

Raines is an associate professor of anesthesia at Harvard Medical School. Co-authors of the Anesthesiology study – supported by grants from the National Institutes of Health and the Foundation for Anesthesia Education and Research – are lead author Joseph Cotton, MD; Shaukat Husain, DPhil; Stuart Forman, MD, PhD, Keith Miller, DPhil; Elizabeth Kelly and Hieu Nguyen, all of the MGH Department of Anesthesia, Critical Care and Pain Medicine. The MGH has filed a patent application for MOC-etomidate and other etomidate analogues.

Embarrassing illnesses no bar to information sharing

People with potentially 'stigmatizing' medical conditions are just as likely as those with less stigmatizing illnesses to allow their personal information to be used for health research. A new study, published in the open access journal BMC Medical Ethics, found that the purpose of the research and the type of information to be collected were more important in determining patients' consent choices. In particular, they were very wary of allowing their personal information to be put to commercial use.

Donald Willison, Senior Scientist with the Ontario Agency for Health Protection and Promotion, Canada, led a team of researchers who surveyed 1137 people who either had potentially stigmatizing conditions (HIV, alcoholism, chronic depression or lung cancer) or lower-stigma conditions (hypertension, breast cancer or diabetes), as well as a reference group of healthy people. They presented the subjects with a series of situations and asked them to indicate how much control they would want over the use of their personal information in each case.

According to Willison, "Across scenarios, consent choice profiles were very similar for all health conditions. They were also very similar to the profile of the reference group. These findings surprised us. It may be that, across health conditions, those who were more privacy-sensitive were less inclined to participate in the study, or it may just be that, where people believe that their information will be put to constructive use, people are equally willing to allow their information to be used, regardless of their health condition."

The researchers found people wanted more control in research scenarios involving profit or those that linked health information with income, education, or occupation. Focus groups were held with some of the respondents where they were asked to explain their choices. One participant from the HIV group said,

"I think the simple answer is that physical tissue sample is just a piece of what you are, what you might be... where the rest of the information [education, income, and employment] is more of who you are. People are more afraid of the revelation of who you are than what you are."

Speaking about the results, Willison said, "Individuals should be offered some choice in use of their information for different types of health research. In some cases, like population health research, that may be limited to selectively opting-out of research projects. In other cases, like linkage of biological samples with one's health information, the process would likely continue to require an opting in, perhaps through a broad consent for a range of uses. Just what choices would be offered would have to be determined through further engagement with the public and other stakeholders. Many questions remain, including how best to capture the opinions of those who are more privacy sensitive."

Notes to Editors

1. *Consent for use of personal information for health research: Do people with potentially stigmatizing health conditions and the general public differ in their opinions?*

Donald J Willison, Valerie Steeves, Cathy Charles, Lisa Schwartz, Jennifer Ranford, Gina Agarwal, Ji Cheng and Lehana Thabane *BMC Medical Ethics* (in press)

During embargo, article available here: http://www.biomedcentral.com/imedia/2106728234247386_article.pdf?random=38202

After the embargo, article available at journal website: <http://www.biomedcentral.com/bmcmedethics/>

Unsung heroes save net from chaos

By Jonathan Fildes Technology reporter, BBC News, Oxford

Crack teams of volunteers keep the net online and functioning, according to leading internet lawyer Jonathan Zittrain of Harvard University. The way data is divided up and sent around the internet in many jumps makes it "delicate and vulnerable" to attacks or mistakes, he said.

However, he added, the "random acts of kindness" of these unsung heroes quietly keep the net in working order.

Professor Zittrain's comments came at the TED Global conference in Oxford.

Incidents such as when the Pakistan government took YouTube offline in 2008 exposed the web's underlying fragility, he explained. But a team of volunteers - unpaid, unauthorised and largely unknown to most people - rolled into action and restored the service within hours.

"It's like when the Bat signal goes up and Batman answers the call," Professor Zittrain told BBC News.

Blind faith

The fragility of the internet's architecture was largely due to its origins, said Professor Zittrain.

He said it had been conceived with "one great limitation and with one great freedom".

"Their limitation was that they didn't have any money," he told the TED audience in Oxford.

"But they had an amazing freedom, which was that they didn't have to make any money from it.

"The internet has no business plan - never did - no CEO, no single firm responsible for building it. Instead it's folks getting together to do something for fun, rather than because they were told to or because they were expecting to make money from it," he said. That ethos, he suggested, had led to a network architecture that was completely unique. "As late as 1992, IBM was known to say that you couldn't build a corporate network using internet protocol."

Internet protocol (IP), the method used to send data around the internet, was first described by Vint Cerf and Bob Kahn in 1974. Data is broken into chunks - or packets - and sent around different parts of the network, often owned by different corporations and entities.

Professor Zittrain likened it to how a drink may be passed along a row of people at a sporting event.

"Your neighbourly duty is to pass the beer along - at risk to your own trousers - to get it to its destination."

"That's precisely how packets move around the internet, sometimes in a many as 25 or 30 hops with the intervening entities passing the data around having no contractual or legal obligation to the original sender or to the receiver." The route the data takes depends on the net's addressing system, he said.

"It turns out there is no overall map of the internet. It is as if we are all sat together in a theatre but we can only see in the fog the people around us. "So what do we do to figure out what is around us. We turn to the person on our right and tell them what we can see to the left and vice versa.

This method, he said, gives network operators a general sense of "what is where".

"This is a system that relies on kindness and trust, which also makes it very delicate and vulnerable," he said.

"In rare but striking instances, a lie told by a single entity within this honeycomb can lead to real trouble."

Bucket brigade

One example, he said, was an incident in 2008 when Pakistan Telecom accidentally took YouTube offline.

At the time, the Pakistan government asked Pakistan's ISPs to block the site, reportedly because of a "blasphemous" video clip. However, a network error caused a worldwide blackout of the site.

"This one ISP in Pakistan decided to [institute] the block for its subscribers in a highly unusual way," said Professor Zittrain. "It advertised that ... it had suddenly awakened to find it was YouTube."

Because of the way that the network spreads messages between neighbours, the announcement quickly reverberated around the world. Within two minutes, YouTube was completely blocked.

"One of the most popular websites in the world, run by the most powerful company in the world, and there was nothing that YouTube or Google were particularly privileged to do about it," said Professor Zittrain.

However, he said, the problem was fixed within about two hours. This was down to a largely unknown group known as the North American Network Operators Group (NANOG), he said. NANOG is a forum for distributing technical information among computer and network engineers.

"They came together to help find a problem and fix it," he said. Despite being unpaid volunteers they were able to put YouTube back on line, he said. "It's kind of like when your house catches on fire," he said.

"The bad news is there is no fire brigade. The good news is that random people appear from nowhere, put out the fire and leave without expecting payment or praise."

The same social structures - and in particular kindness and trust - are also responsible for websites such as Wikipedia, he said. "It's like dark matter in the universe. There's a lot of it, you don't see it but it has a huge impact on the physics of the place," he earlier told the BBC.

This year's TED Global conference runs from 21 to 24 July.

Wireless power system shown off

By Jonathan Fildes Technology reporter, BBC News, Oxford

A system that can deliver power to devices without the need for wires has been shown off at a hi-tech conference. The technique exploits simple physics and can be used to charge a range of electronic devices.

Eric Giler, chief executive of US firm Witricity, showed mobile phones and televisions charging wirelessly at the TED Global conference in Oxford.

He said the system could replace the miles of expensive power cables and billions of disposable batteries.

"There is something like 40 billion disposable batteries built every year for power that, generally speaking, is used within a few inches or feet of where there is very inexpensive power," he said.

Trillions of dollars, he said, had also been invested building an infrastructure of wires "to get power from where it is created to where it is used." "We love this stuff [electricity] so much," he said.

Mr Giler showed off a Google G1 phone and an Apple iPhone that could be charged using the system.

Witricity, he said, had managed to pack all the necessary components into the body of the G1 phone, but Apple had made that process slightly harder. "They don't make it easy at Apple to get inside their phones so we put a little sleeve on the back," he said.

He also showed off a commercially available television using the system.

"Imagine you get one of these things and you want to hang it on the wall," he said. "Think about it, you don't want those ugly cords hanging down."

Good vibrations

The system is based on work by physicist Marin Soljagic at the Massachusetts Institute of Technology (MIT). It exploits "resonance", whereby energy transfer is markedly more efficient when a certain frequency is applied.

When two objects have the same resonant frequency, they exchange energy strongly without having an effect on other, surrounding objects.

For example, it is resonance that can cause a wine glass to explode when a singer hits exactly the right tone.

But instead of using acoustic resonance, Witricity's approach exploits the resonance of low frequency electromagnetic waves.

The system uses two coils - one plugged into the mains and the other embedded or attached to the gadget.

Each coil is carefully engineered with the same resonant frequency. When the main coil is connected to an electricity supply, the magnetic field it produces is resonant with that of with the second coil, allowing "tails" of energy to flow between them. As each "cycle" of energy arrives at the second coil, a voltage begins to build up that can be used to charge the gadget.

Mr Giler said the main coil could be embedded in the "ceiling, in the floor, or underneath your desktop".

Devices using the system would automatically begin to charge as soon as they were within range, he said.

"You'd never have to worry about plugging these things in again."

Safety concerns

Mr Giler was keen to stress the safety of the equipment during the demonstration.

"There's nothing going on - I'm OK," he said walking around a television running on wireless power.

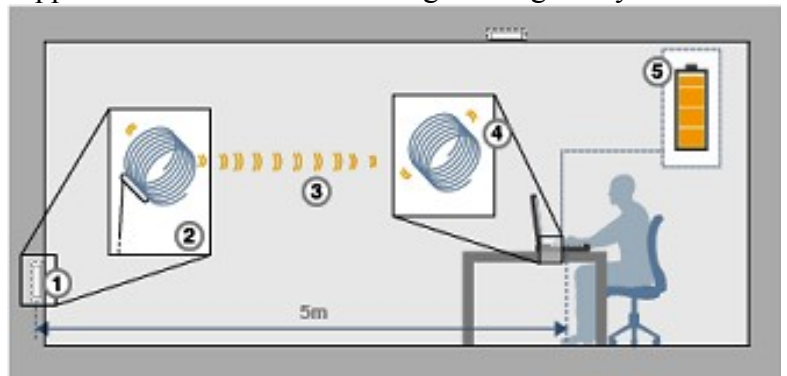
The system is able to operate safely because the energy is largely transferred through magnetic fields.

"Humans and the vast majority of objects around us are non-magnetic in nature," Professor Soljagic, one of the inventors of the system, told BBC News during a visit to Witricity earlier this year.

It is able to do this by exploiting an effect that occurs in a region known as the "far field", the region seen at a distance of more than one wavelength from the device.

In this field, a transmitter would emit mixture of magnetic and potentially dangerous electric fields.

But, crucially, at a distance of less than one wavelength - the "near field" - it is almost entirely magnetic.



HOW WIRELESS POWER WORKS

- # 1. *First magnetic coil (Antenna A) housed in a box and can be set in wall or ceiling*
- # 2. *Antenna A, powered by mains, resonates at a specific frequency*
- # 3. *Electromagnetic waves transmitted through the air*
- # 4. *Second magnetic coil (Antenna B) fitted in laptop/TV etc resonates at same frequency as first coil and absorbs energy*
- # 5. *Energy charges the device*

Hence, Witricity uses low frequency electromagnetic waves, whose waves are about 30m (100ft) long. Shorter wavelengths would not work.

'Ridiculous technology'

Witricity is not the first jump on the concept of wireless electricity. For example, the nineteenth century American inventor Thomas Edison and physicist and engineer Nikola Tesla explored the concept.

"In the very early days of electricity before the electric grid was deployed [they] were very interested in developing a scheme to transmit electricity wirelessly over long distances," explained Professor Soljagic.

"They couldn't imagine dragging this vast infrastructure of metallic wires across every continent."

Tesla even went so far as to build a 29m-high aerial known as Wardencliff Tower in New York.

"It ran into some financial troubles and that work was never completed," said Professor Soljagic.

Today, chip-giant Intel has seized on a similar idea to Witricity's, whilst other companies work on highly directional mechanisms of energy transfer, such as lasers.

However, unlike Witricity's work, lasers require an uninterrupted line of sight, and are therefore not good for powering objects around the home.

In contrast, Mr Giler said Witricity's approach could be used for a range of applications from laptops and phones to implanted medical devices and electric cars. "Imagine driving in the garage and the car charges itself," he said. He even said he had had interest from a company who proposed to use the system for an "electrically-heated dog bowl". "You go from the sublime to the ridiculous," he said.

Ted Global is a conference dedicated to "ideas worth spreading". It runs from the 21 to 24 July in Oxford, UK.

Researcher Condemns Conformity Among His Peers

By Nicholas Wade

"Academics, like teenagers, sometimes don't have any sense regarding the degree to which they are conformists."

So says Thomas Bouchard, the Minnesota psychologist known for his study of twins raised apart, in a retirement interview with Constance Holden in the journal *Science*.

Journalists, of course, are conformists too. So are most other professions. There's a powerful human urge to belong inside the group, to think like the majority, to lick the boss's shoes, and to win the group's approval by trashing dissenters.

The strength of this urge to conform can silence even those who have good reason to think the majority is wrong. You're an expert because all your peers recognize you as such. But if you start to get too far out of line with what your peers believe, they will look at you askance and start to withdraw the informal title of "expert" they have implicitly bestowed on you. Then you'll bear the less comfortable label of "maverick," which is only a few stops short of "scapegoat" or "pariah."

A remarkable first-hand description of this phenomenon was provided a few months ago by the economist Robert Shiller, co-inventor of the Case-Shiller house price index. Dr. Shiller was concerned about what he saw as an impending house price bubble when he served as an adviser to the Federal Reserve Bank of New York up until 2004.

So why didn't he burst his lungs warning about the impending collapse of the housing market? "In my position on the panel, I felt the need to use restraint," he relates. "While I warned about the bubbles I believed were developing in the stock and housing markets, I did so very gently, and felt vulnerable expressing such quirky views. Deviating too far from consensus leaves one feeling potentially ostracized from the group, with the risk that one may be terminated."

Conformity and group-think are attitudes of particular danger in science, an endeavor that is inherently revolutionary because progress often depends on overturning established wisdom. It's obvious that at least 100 genes must be needed to convert a human or animal cell back to its embryonic state. Or at least it was obvious to almost everyone until Shinya Yamanaka of Kyoto University showed it could be done with just 4.

The academic monocultures referred to by Dr. Bouchard are the kind of thing that sabotages scientific creativity. Though they sprout up in every country, they may be a particular problem in Confucian-influenced cultures that prize conformity and respect for elders. It's curious that Japan, for example, despite having all the ingredients of a first rate scientific power – a rich economy, heavy investment in R&D, a highly educated population and a talented scientific workforce – has never posed a serious challenge to American scientific leadership. Young American scientists can make their name by showing their professor is dead wrong; in Tokyo or Kyoto, that's a little harder to do.

If the brightest minds on Wall Street got suckered by group-think into believing house prices would never fall, what other policies founded on consensus wisdom could be waiting to come unraveled? Global warming,

you say? You mean it might be harder to model climate change 20 years ahead than house prices 5 years ahead? Surely not – how could so many climatologists be wrong?

What's wrong with consensus is not the establishment of a majority view, which is necessary and legitimate, but the silencing of skeptics. "We still have whole domains we can't talk about," Dr. Bouchard said, referring to the psychology of differences between races and sexes.

Swine Flu May Cause Seizures in Children

By SARAH ARNQUIST

The nation's top public health officials are alerting doctors that swine flu may cause seizures, after four children were hospitalized in Texas for neurological complications.

All four children fully recovered without complications after being treated at a Dallas hospital, according to a report released Thursday by the Centers for Disease Control and Prevention.

The announcement does not surprise doctors accustomed to seeing complications in the brain caused by the seasonal flu viruses that circulate every year.

"It's completely to be expected given that so far this novel H1N1 flu is behaving like the seasonal flu that we are familiar with," said Dr. Anne Moscona, a professor of pediatrics and microbiology at the Weill Cornell Medical Center.

Because flu-related brain complications are more common in children than adults and swine flu seems to infect children more often than adults, public health experts expect to see more cases of children who develop swine-flu-related neurological complications as the pandemic continues.

Parents should not be alarmed, Dr. Moscona said, but if they notice a change in their child's personality or behavior, like increased irritability or memory problems, soon after the onset of a respiratory illness, it might be swine-flu related and parents should alert their child's doctor as early as possible.

In the four children described in the disease centers' report, neurological problems, including seizures, confusion and delirium, followed the onset of respiratory symptoms within one to four days. The complications were less severe than those previously described in the medical literature as associated with seasonal flu, according to the report.

Neurological complications in children are among the most serious side effects of influenza, said Dr. Andrew T. Pavia, chief of pediatric infectious diseases at the University of Utah. Milder complications like seizures or brain swelling are moderately common, whereas death occurs in only a couple of cases each year, Dr. Pavia said.

Some flu strains are worse than others when it comes to causing brain-related complications, and scientists do not yet know how bad H1N1 will be, he said.

Most swine flu cases so far have been fairly mild, but many questions remain about the severe cases, like what complications are most likely and who is most likely to develop them, he said.

"The usefulness of this case report is that many doctors who deal with outpatient flu only may never have seen a case with neurological complications," Dr. Pavia said. "It's an important reminder that flu can present as seizures or as encephalitis."

Human cells secrete cancer-killing protein, UK study finds

Research builds on previous Par-4 study that produced cancer-resistant mouse

Human cells are able to secrete a cancer-killing protein, scientists at the University of Kentucky's Markey Cancer Center have found.

Researchers led by Vivek Rangnekar, UK professor of radiation medicine, have determined that the tumor-suppressor protein Par-4, initially thought to be active only within cells expressing the Par-4 gene, is in fact secreted by most human and rodent cells and can target large numbers of cancer cells by binding to receptors on the cell surface. This discovery, published today in the leading journal *Cell*, makes Par-4 a very attractive molecule for future research aimed at developing new cancer treatments.

"It was a pleasant surprise, when we noticed that Par-4 protein is secreted by cells," Rangnekar said. "This new finding means it is not necessary to make genetic modifications, or to employ recombinant viruses, to deliver the Par-4 gene to cancer cells, and it significantly expands the potential applications of Par-4 to selectively kill cancer cells."

Funded by several grants from the National Institutes of Health, Rangnekar's study found that when the Par-4 molecule binds to its receptor GRP78 on the surface of a tumor cell, it triggers a biological process called apoptosis or "cell suicide." Consistent with previous research by Rangnekar's laboratory with intracellular Par-4, the newly discovered secreted Par-4 acts selectively against cancer cells, leaving healthy cells unharmed. Few other molecules are known to exhibit such selectivity.

One molecule, known as TRAIL, also exerts cancer-cell-specific effects. However, Rangnekar's most recent study discovered that apoptosis inducible by TRAIL is dependent upon extracellular Par-4 signaling via cell surface GRP78. Thus, the researchers conclude, Par-4 activates a novel pathway involving cell surface GRP78 receptor for induction of apoptosis. In other words, without Par-4, TRAIL lacks the ability to cause "cell suicide."

Rangnekar first discovered the Par-4 gene in 1993. In 2007, Rangnekar's team introduced the gene into a mouse embryo, creating a cancer-resistant "supermouse" that did not develop tumors. In fact, the mice possessing Par-4 actually live a few months longer than lab mice without the gene, indicating that Par-4 mice have no toxic side effects.

While Par-4 is not necessarily a "magic bullet" - it does not target every type of cancer cell - Rangnekar says it could play a major role in developing new combination treatment modalities for cancer patients. His hope is that the next generation of treatments will be even more effective than conventional treatments available today, with fewer and less severe side effects.

"I look at this research from the standpoint of how it can be developed to benefit the cancer patient, and that's what keeps us focused," Rangnekar said, discussing the potential of Par-4 in 2007. "The pain that cancer patients go through - not just from the disease, but also from the treatment - is excruciating. If you can treat the cancer and not harm the patient, that's a major breakthrough."

Rangnekar holds the Alfred Cohen, M.D., Endowed Chair in Oncology Research at the UK College of Medicine.

Artificial brain '10 years away'

By Jonathan Fildes Technology reporter, BBC News, Oxford

A detailed, functional artificial human brain can be built within the next 10 years, a leading scientist has claimed. Henry Markram, director of the Blue Brain Project, has already simulated elements of a rat brain.

He told the TED Global conference in Oxford that a synthetic human brain would be of particular use finding treatments for mental illnesses. Around two billion people are thought to suffer some kind of brain impairment, he said. "It is not impossible to build a human brain and we can do it in 10 years," he said.

"And if we do succeed, we will send a hologram to TED to talk."

'Shared fabric'

The Blue Brain project was launched in 2005 and aims to reverse engineer the mammalian brain from laboratory data. In particular, his team has focused on the neocortical column - repetitive units of the mammalian brain known as the neocortex.

"It's a new brain," he explained. "The mammals needed it because they had to cope with parenthood, social interactions complex cognitive functions. It was so successful an evolution from mouse to man it expanded about a thousand fold in terms of the numbers of units to produce this almost frightening organ. And that evolution continues, he said. "It is evolving at an enormous speed."

Over the last 15 years, Professor Markram and his team have picked apart the structure of the neocortical column. "It's a bit like going and cataloguing a bit of the rainforest - how many trees does it have, what shape are the trees, how many of each type of tree do we have, what is the position of the trees, he said. But it is a bit more than cataloguing because you have to describe and discover all the rules of communication, the rules of connectivity."

The project now has a software model of "tens of thousands" of neurons - each one of which is different - which has allowed them to digitally construct an artificial neocortical column.

Although each neuron is unique, the team has found the patterns of circuitry in different brains have common patterns. "Even though your brain may be smaller, bigger, may have different morphologies of neurons - we do actually share the same fabric," he said.

"And we think this is species specific, which could explain why we can't communicate across species."

World view

To make the model come alive, the team feeds the models and a few algorithms into a supercomputer.

"You need one laptop to do all the calculations for one neuron," he said. "So you need ten thousand laptops."

Instead, he uses an IBM Blue Gene machine with 10,000 processors.

Simulations have started to give the researchers clues about how the brain works.

For example, they can show the brain a picture - say, of a flower - and follow the electrical activity in the machine. "You excite the system and it actually creates its own representation," he said.

Ultimately, the aim would be to extract that representation and project it so that researchers could see directly how a brain perceives the world.

But as well as advancing neuroscience and philosophy, the Blue Brain project has other practical applications. For example, by pooling all the world's neuroscience data on animals - to create a "Noah's Ark",

researchers may be able to build animal models. "We cannot keep on doing animal experiments forever," said Professor Markram.

It may also give researchers new insights into diseases of the brain. "There are two billion people on the planet affected by mental disorder," he told the audience. The project may give insights into new treatments, he said.

The TED Global conference runs from 21 to 24 July in Oxford, UK.

Radioactive Drug for Tests Is in Short Supply

By MATTHEW L. WALD

WASHINGTON — A global shortage of a radioactive drug crucial to tests for cardiac disease, cancer and kidney function in children is emerging because two aging nuclear reactors that provide most of the world's supply are shut for repairs.

The 51-year-old reactor in Ontario, Canada, that produces most of this drug, a radioisotope, has been shut since May 14 because of safety problems, and it will stay shut through the end of the year, at least.

Some experts fear it will never reopen. The isotope, technetium-99m, is used in more than 40,000 medical procedures a day in the United States.

Loss of the Ontario reactor created a shortage over the last few weeks. But last Saturday a Dutch reactor that is the other major supplier also closed for a month.

The last of the material it produced is now reaching hospitals and doctors' offices. The Dutch reactor, at Petten, is 47 years old, and even if it reopens on schedule, it will have to be shut for several months in 2010 for repairs, its operators say.

"This is a huge hit," said Dr. Michael M. Graham, president of the Society of Nuclear Medicine and a professor of radiology at the University of Iowa.

There are substitute techniques and materials for some procedures that use the isotope, Dr. Graham and others said, but they are generally less effective, more dangerous or more expensive. With the loss of diagnostic capability, "some people will be operated on that don't need to be, and vice versa," he said.

Dr. Andrew J. Einstein, an assistant professor of clinical medicine at the Columbia University College of Physicians and Surgeons, said the isotope was used to determine if a patient had a coronary blockage that required an angioplasty or stent. Without the test, Dr. Einstein said, those invasive procedures would be performed on some who did not need them. His hospital is already sometimes using smaller doses of the radioactive drug than guidelines specify, he said.

In patients with a known cancer, the drug pinpoints additional tumors in bone. At a tumor site, new bone will develop, and new bone growth absorbs the radioactive material.

In breast cancer surgery, the radioisotope is injected to find the lymph node nearest the tumor, so it can be biopsied for signs of cancer, to determine whether more extensive surgery is needed.

The alternative is to inject a dye, which sometimes does not let the surgeon find the node.

Without the tool, Dr. Graham said, the quality of medical care is "dropping back into the 1960s."

On Tuesday, Representative Edward J. Markey, a Massachusetts Democrat who is one of the House's fiercest critics of the nuclear industry, declared that the United States was facing "a crisis in nuclear medicine."

Mr. Markey, chairman of the House Energy and Commerce subcommittee on energy, called for establishing new production facilities in the United States. He joined the ranking Republican on the subcommittee, Representative Fred Upton of Michigan, to introduce a bill to authorize \$163 million over five years to assure new production.

The White House is coordinating an interagency effort to find new sources of supply, involving the Nuclear Regulatory Commission, the Food and Drug Administration and the Energy Department, but officials said the process would take months.

The reactors are typically small - sometimes no larger than a homeowner's trash barrel - but a complete setup costs tens of millions of dollars.

Tech-99m, as it is abbreviated, emits a gamma ray that makes its presence obvious. It has a half-life of six hours, meaning that it loses half its strength in that period. Thus it does its job quickly, without lingering to give the patient a big dose. But it also means the isotope must be produced and used faster than most other drugs.

Tech-99m is the product of another isotope, molybdenum-99, which also has a short half-life, 66 hours. Thus a week after it is made, less than a quarter of the molybdenum-99 remains. Stockpiling is not practical.

"You lose about 1 percent an hour," said another expert, Kevin D. Crowley, director of the Nuclear and Radiation Studies Board at the National Research Council. "So time is of the essence."

Molybdenum-99 is made when uranium-235 is split, but only about 6 percent of the fission fragments are molybdenum. Purification has to be done in a heavily shielded "hot cell."

The common method is to put a uranium target into the stream of neutrons produced in the reactor as uranium is split. But the preferred material is a high-purity uranium-235, which is also bomb fuel.

Mr. Markey and others are trying to have the industry switch to low-enriched - nonweapons-grade - uranium.

Dr. Crowley said that could be done, although the industry has resisted.

The reactors' poor condition has been obvious for a while. In 2007, Canadian safety regulators said the Ontario reactor should not restart, but the Canadian Parliament overruled them.

In 1996, the company that purifies the molybdenum from the Ontario reactor, MDS Nordion, contracted with Atomic Energy of Canada Ltd., which owns the reactor, to build two new ones. MDS Nordion paid more than \$350 million for them.

But when the new reactors were started up, both showed a problem: as the power level increased, the reactors had a tendency to run faster and faster, a condition called positive coefficient of reactivity. That is a highly undesirable characteristic in a reactor, one that contributed heavily to the Chernobyl disaster in 1986. So Atomic Energy of Canada Ltd., which is owned by the Canadian government, said it would not open them.

For all the years that the Ontario plant was running or the replacements were under construction, other potential manufacturers believed they could not compete, Dr. Klein said. And the business has always been small, he said, adding that a big pharmaceutical company "can make more on Viagra in two days than on tech-99m in a year."

Several long-term alternatives are available. Babcock & Wilcox, a reactor manufacturer, has proposed a new kind of reactor that would manufacture molybdenum that could be siphoned off continuously.

In a few weeks, a company in Kennewick, Wash., Advanced Medical Isotopes, plans to test a new system, using a linear accelerator, a machine that shoots subatomic particles at high speeds.

Reactors in Belgium, France, South Africa and Argentina could also be used to make small amounts.

The High Flux Reactor at the Oak Ridge National Laboratory in Tennessee, owned by the federal government, and a research reactor at the University of Missouri, could do the work, but neither has the equipment in place to extract the molybdenum from the targets.

For the time being, said Dr. Crowley of the National Research Council, "we are in a triage situation."

Is your cat left or right pawed?

* 10:28 24 July 2009 by **Ewen Callaway**

It may not be obvious from the scratch marks cats dish out, but domestic felines favour one paw over the other. More often than not, females tend to be righties, while toms are lefties, say Deborah Wells and Sarah Millsopp, psychologists at Queen's University Belfast in Northern Ireland.

However, these preferences only manifest when cats perform particularly dexterous feats. That's for the same reason we can open a door with either arm, yet struggle to write legibly with our non-dominant hand. "The more complex and challenging [the task], the more likely we're going to see true handedness," Wells says.



Raise your best paw photograph.image.coocan.jp

She and Millsopp tasked 42 domestic cats to ferret out a bit of tuna in a jar too small for their heads. Among 21 females, all but one favoured the right paw across dozens of trials, while 20 out of 21 males preferentially used the left. One male proved ambidextrous.

Not so for two simpler activities: pawing at a toy mouse suspended in the air or dragged on ground from a string. No matter their sex, all of the cats wielded their right and left paws about equally on these less demanding tasks.

Hormone levels could explain sex differences in paw choice, Wells says. Previous research has linked prenatal testosterone exposure to left-handedness. While studies of two other domestic animals, dogs and horses, revealed similar sex biases. *Journal reference: Animal Behaviour (DOI: 10.1016/j.anbehav.2009.06.010)*

How to make ice melt at -180 °C

HOW can ice possibly melt in the extreme cold of -180 °C? The answer is if the ice crystals contain just 48 water molecules.

Bernd von Issendorff at the University of Freiburg in Germany and his colleagues created ice clusters of just a few tens of water molecules, tagged with an extra electron. The electron's charge allowed the team to trap the clusters in electric fields and weed out those of the wrong size.

As the ice clusters were ten thousand times smaller than a grain of sand, the researchers couldn't merely watch them melt. Instead, at temperatures ranging from -265 °C to -80 °C, they triggered the evaporation of a few molecules with pulses of laser light. By counting the number of molecules that evaporated, they could

calculate the energy of each cluster before it was zapped. Since liquids contain more energy than solids, they could deduce the temperature at which the clusters melted.

The researchers were surprised to find melting began at just under -180°C. "Probably anybody would have guessed that a small amount of water behaves differently, but maybe not so many that it is so different," says von Issendorff, whose team's finding will appear in *Physical Review Letters*.

Von Issendorff and his colleagues expect their findings will fine-tune models that explain and predict cloud formation and climate, atmospheric chemistry, and the evolution of water-rich objects in outer space, such as fledgling comets.

Pinpointing cause of colic: UT Houston research identifies organism that could trigger constant crying

HOUSTON – Researchers at The University of Texas Health Science Center at Houston say one organism discovered during their study may unlock the key to what causes colic, inconsolable crying in an otherwise healthy baby.

"Right now, pediatric gastroenterologists can treat just about anything that comes through the door," said J. Marc Rhoads, M.D., professor of pediatrics at The University of Texas Medical School at Houston, which is part of the UT Health Science Center at Houston. "With colic, there is no evidence-based treatment we can offer. Colic can be a dangerous situation for a baby. The parent's frustration over the crying can lead to maternal frustration, post-partum depression and even thoughts of harming the baby."

Published in today's online edition of the *Journal of Pediatrics*, the study pointed to an organism called *Klebsiella*, a normally occurring bacterium that can be found in the mouth, skin and intestines. In the study of 36 babies, half of which had colic, researchers found the bacterium and gut inflammation in the intestines of the babies with colic.

"We believe that the bacterium may be sparking an inflammatory reaction, causing the gut inflammation," said Rhoads, the lead investigator for the study. "Inflammation in the gut of colicky infants closely compared to levels in patients with inflammatory bowel disease. Colic could prove to be a precursor to other gastrointestinal conditions such as irritable bowel syndrome, celiac disease and allergic gastroenteropathies."

Babies in the study were fed breast milk and/or formula. Previous research articles have not shown significant data supporting the theory that breastfeeding protects infants against colic. The babies in the study were recruited from UT Physicians' pediatric clinics and Kelsey-Seybold clinics.

Colic is defined as unexplained and severe crying in an otherwise healthy newborn. It usually occurs in infants three months old or younger and lasts for more than three hours daily for at least three days a week. "Colic is a very common condition. It affects about 15 percent of normal, healthy infants. More than half of infant deaths fall into the age category of colic. We may be able to prevent deaths if we can find a treatment," Rhoads said.

Right now, pediatricians prescribe special hypoallergenic infant formula to try and treat colic, but none of it has been proven in studies to be effective in treating the condition.

"During our study, we also found that the babies that didn't have colic had more types of bacteria in their intestines. The presence of more bacteria may indicate that specific bacterial species (phylotypes) are beneficial to humans," Rhoads said. The study was funded by the Gerber Foundation.

A larger study is needed to examine *Klebsiella* and the use of a probiotic, which is a dietary supplement made up of good bacteria, to control the gut inflammation. Before that can begin, Rhoads said an adult trial will take place to examine the safety of the probiotics in healthy adults. For that study, UT researchers are recruiting 40 adult patients.

Other research personnel at the UT Medical School included Nicole Fatheree, research coordinator; Yuying Liu, Ph.D., researcher; Joseph Lucke, Ph.D. and Jon E. Tyson, M.D., professor of pediatrics and obstetrics and Michelle Bain Distinguished Professor in Medicine and Public Health.

UAB Computer Forensics Links Fake Online Postcards to Most Prevalent U.S. Computer Virus

- ***Fake e-postcards carry password-stealing virus***
- ***Virus considered the country's most pervasive***

BIRMINGHAM, Ala. - Fake Internet postcards circulating through e-mail inboxes worldwide are carrying links to the virus known as Zeus Bot, said Gary Warner, director of computer forensics at the University of Alabama at Birmingham (UAB). Zeus Bot has been named America's most pervasive computer Botnet virus by Network World magazine, reportedly infecting 3.6 million U.S. computers.

"These fake postcards ask users to click and download to view the contents, and as soon as that click is made the Zeus Bot malware has infected their computers," Warner said. "Once on a user's computer, Zeus Bot will give cyber criminals access to passwords and account numbers for bank, e-mail and other sensitive online accounts."

A Botnet is a collection of compromised or infected computers that runs specific software that usually has been installed on computers without the user's knowledge.

Warner said cyber criminals who are employing the Russian-language Zeus Bot software are using the fake Internet postcards as the latest mechanism to download the virus software onto unwitting users' computers.

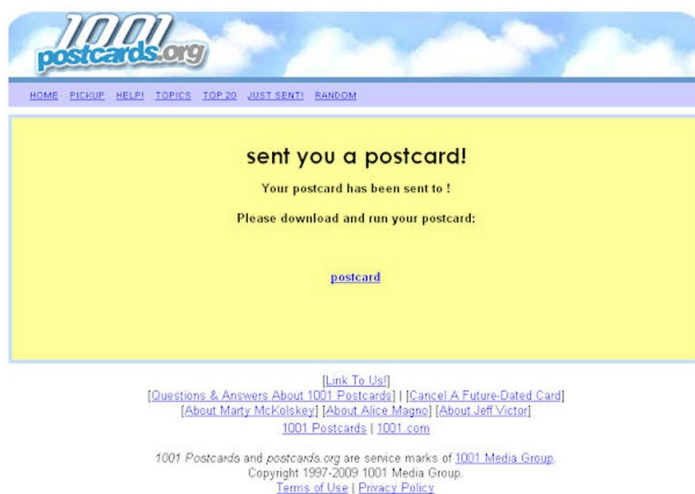
Once the virus is on a computer it becomes a part of the Zeus Botnet and is able to steal Web site data from victims. The malware uses a graphical user interface to keep track of infected machines throughout the world and is equipped with tools that allow the criminals to prioritize the banks and related stolen accounts they want to strike, Warner said.

"These messages are standard in their design and carry a subject line that indicates they come from the Web site 1001 Postcards," Warner said.

"In this case and when it comes to messages that are supposedly from your bank, eBay or any other site, don't click on the links in an e-mail," Warner said. "Instead, type the address for the site that the message is coming from into your Web browser and log in as you normally would. If the site has an important message for you, you'll be able to find it."

Read more at Warner's blog at

<http://garwarner.blogspot.com/>. Learn more about Warner at <http://main.uab.edu/Sites/MediaRelations/Experts/39555/>.



Common allergy drug reduces obesity and diabetes in mice **Written by David Cameron**

BOSTON, Mass. (July 26, 2009) — Crack open the latest medical textbook to the chapter on type 2, or adult-onset, diabetes, and you'll be hard pressed to find the term "immunology" anywhere. This is because metabolic conditions and immunologic conditions are, with a few exceptions, distant cousins.

However, a group of papers appearing in *Nature Medicine*, two of which are from Harvard Medical School researchers, have linked type 2 diabetes with immunology in a way that might persuade leading researchers to start viewing them as siblings.

In the first study, researchers used two common over-the-counter allergy medications to reduce both obesity and type 2 diabetes in mice. The medications, called Zaditor and cromolyn, stabilize a population of inflammatory immune cells called mast cells. In the second study, researchers found that a kind of white blood cell called a regulatory T cell, once thought to manage only other white blood cells, also acts as a liaison between the metabolic and immune systems—in this case, controlling inflammation in fat tissue. Fat tissue from obese and insulin-resistant mice and people is marked by a dramatic absence of this cell type, in dramatic contrast to an already reported overabundance in fat tissue of inflammatory immune cells called macrophages.

"It seems that we're seeing the emergence of a new biomedical discipline: immunometabolism," says HMS professor of pathology Diane Mathis, senior author on one of the papers.

Both papers will appear online July 26 in *Nature Medicine*.

Molecular garbage

Type 1 and type 2 diabetes both involve abnormalities in the insulin-producing beta cells of the pancreas, but their root causes are completely different. Type 1 diabetes is an autoimmune disease in which the immune system attacks the pancreas, destroying its ability to produce insulin. In contrast, type 2 diabetes is a strictly

metabolic condition in which cells grow increasingly deaf to insulin signals and thus lose their ability to metabolize glucose. In both cases, glucose mounts in the blood, at times to fatal levels.

But it is becoming increasingly clear that we should also think of type 2 diabetes in the context of immune function, Harvard scientists assert.

Guo-Ping Shi, Biochemist from the Department of Medicine, Brigham and Women's Hospital and Harvard Medical School, began to suspect such a connection when, in a previous study, he found mast cells present in a variety of inflammatory vascular diseases.

Mast cells are immune cells that facilitate healing in wounded tissue, primarily by increasing blood flow to the site. However, in certain conditions mast cells build up to levels far beyond what the body needs. As a result these cells become unstable and eventually, like punctured trash bags, leak molecular "garbage" into the tissue. This can result in chronic inflammation that causes asthma and certain allergies.

As Shi and postdoctoral research fellow Jian Liu discovered, mast cells were far more abundant in fat tissue from obese and diabetic humans and mice than they were in normal weight fat tissue. This led to an obvious question: by regulating mast cells, could we then control the symptoms?

To find out, Shi and colleagues took a group of obese and diabetic mice and, for a period of two months, treated them with either ketotifen fumarate (also called Zaditor) or cromolyn, both over-the-counter allergy drugs.

"We knew from published research that both cromolyn and Zaditor help stabilize mast cells in people suffering from allergy or asthma," said Shi. "It's almost as if the drugs place an extra layer of plastic on the ripped trash bag. So it seemed like a logical place to begin."

The mice were divided into four groups. The first was the control group; the second group was simply switched to a healthy diet; the third was given cromolyn or ketotifen fumarate; and the fourth was both given the drug and switched to a healthy diet. While symptoms of the second group improved moderately, the third group demonstrated dramatic improvements in both body weight and diabetes. The fourth group exhibited nearly 100 percent recovery in all areas.

To bolster these findings, Shi and colleagues then took a group of mice whose ability to produce mast cells was genetically impaired. Despite three months of a diet rich in sugar and fat, these mice neither became obese nor developed diabetes.

"The best thing about these drugs is that we know it's safe for people," says Shi. "The remaining question now is: Will this also work for people?"

Shi now intends to test both cromolyn and ketotifen fumarate on obese and diabetic non-human primates.

Beyond friendly fire

In findings independent of Shi, researchers at Harvard Medical School and Joslin Diabetes Center discovered that a class of immune system cells called regulatory T cells, or Tregs, were abundant in the abdominal fat tissue of normal-weight humans and mice, but were virtually absent in the same tissue from obese and diabetic humans and mice.

Their numbers were inversely correlated with the numbers of a class of inflammatory immune cells, macrophages, in a sense creating parallel universes of fat. While obese and diabetic fat tissue was full of inflammatory macrophages and nearly absent of Tregs, normal-weight fat tissue was the diametric opposite.

"For immunologists this is very important, because Tregs had always been thought to control other T cells and that's it," says Markus Feuerer, a postdoctoral researcher in the lab of HMS professors of pathology Diane Mathis and Christophe Benoist. "But this is an entirely new concept." Mathis and Benoist collaborated on the study with Steven Shoelson, HMS professor of medicine at the Joslin Diabetes Center.

"I come at this studying the effects of obesity and why it can spread systemically to cause chronic health problems," says Shoelson, an endocrinologist. "It's possible that the inflammation caused by macrophages results in insulin resistance. And it's more likely, from what we've just seen, that Tregs are keeping the macrophages in check in normal fat tissue, thus preventing inflammation."

For over a decade, Tregs have been known as guardians for the immune system, ensuring that when white blood cells attack a foreign pathogen they don't become overzealous and harm healthy host tissue in a kind of friendly fire. Malfunctioning Tregs, however, have recently been implicated in diseases as diverse as multiple sclerosis and certain cancers.

"Now we're seeing that Tregs may be needed to prevent metabolic abnormalities as well," says Mathis. She adds, half joking, "As an immunologist, I always thought that type 2 diabetes was a pretty boring condition. After these findings, I'm starting to change my mind."

Both studies were funded by the National Institutes of Health.

Full citation: *Nature Medicine*, July 26, 2009, early online publication

"Genetic deficiency and pharmacological stabilization of mast cells reduce diet-induced obesity and diabetes in mice"

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"Lean, but not obese, fat is enriched for a unique population of regulatory T cells that affect metabolic parameters"

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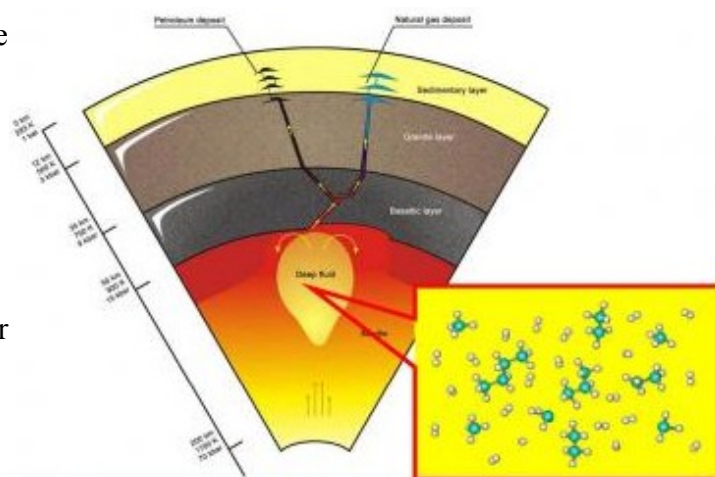
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Hydrocarbons in the deep Earth?

Washington, DC—The oil and gas that fuels our homes and cars started out as living organisms that died, were compressed, and heated under heavy layers of sediments in the Earth's crust. Scientists have debated for years whether some of these hydrocarbons could also have been created deeper in the Earth and formed without organic matter. Now for the first time, scientists have found that ethane and heavier hydrocarbons can be synthesized under the pressure-temperature conditions of the upper mantle—the layer of Earth under the crust and on top of the core. The research was conducted by scientists at the Carnegie Institution's Geophysical Laboratory, with colleagues from Russia and Sweden, and is published in the July 26, advanced on-line issue of Nature Geoscience.



This artistic view of the Earth's interior shows hydrocarbons forming in the upper mantle and transported through deep faults to shallower depths in the Earth's crust. The inset shows a snapshot of the methane dissociation reaction studied in this work. Image courtesy A. Kolesnikov and V. Kutcherov

Methane (CH₄) is the main constituent of natural gas, while ethane (C₂H₆) is used as a petrochemical feedstock. Both of these hydrocarbons, and others associated with fuel, are called saturated hydrocarbons because they have simple, single bonds and are saturated with hydrogen. Using a diamond anvil cell and a laser heat source, the scientists first subjected methane to pressures exceeding 20 thousand times the atmospheric pressure at sea level and temperatures ranging from 1,300 F° to over 2,240 F°. These conditions mimic those found 40 to 95 miles deep inside the Earth. The methane reacted and formed ethane, propane, butane, molecular hydrogen, and graphite. The scientists then subjected ethane to the same conditions and it produced methane. The transformations suggest heavier hydrocarbons could exist deep down. The reversibility implies that the synthesis of saturated hydrocarbons is thermodynamically controlled and does not require organic matter.

The scientists ruled out the possibility that catalysts used as part of the experimental apparatus were at work, but they acknowledge that catalysts could be involved in the deep Earth with its mix of compounds.

"We were intrigued by previous experiments and theoretical predictions," remarked Carnegie's Alexander Goncharov a coauthor. "Experiments reported some years ago subjected methane to high pressures and temperatures and found that heavier hydrocarbons formed from methane under very similar pressure and temperature conditions. However, the molecules could not be identified and a distribution was likely. We overcame this problem with our improved laser-heating technique where we could cook larger volumes more uniformly. And we found that methane can be produced from ethane."

The hydrocarbon products did not change for many hours, but the tell-tale chemical signatures began to fade after a few days.

Professor Kutcherov, a coauthor, put the finding into context: "The notion that hydrocarbons generated in the mantle migrate into the Earth's crust and contribute to oil-and-gas reservoirs was promoted in Russia and Ukraine many years ago. The synthesis and stability of the compounds studied here as well as heavier hydrocarbons over the full range of conditions within the Earth's mantle now need to be explored. In addition, the extent to which this 'reduced' carbon survives migration into the crust needs to be established (e.g., without being oxidized to CO₂). These and related questions demonstrate the need for a new experimental and theoretical program to study the fate of carbon in the deep Earth."

This research was supported by the U.S. Department of Energy, the National Nuclear Security Agency through the Carnegie/DOE Alliance Center, the National Science Foundation, the W.M. Keck Foundation, and the Carnegie Institution.

Should Thursday Be the New Friday? The Environmental and Economic Pluses of the 4-Day Workweek

Evidence builds that working 40 hours in four days makes good sense for employee health and well-being, too

By Lynne Peoples

As government agencies and corporations scramble to cut expenses, one idea gaining widespread attention involves cutting something most employees wouldn't mind losing: work on Fridays. Regular three-day weekends, without a decrease in the actual hours worked per week, could not only save money, but also ease pressures on the environment and public health, advocates say. In fact, several states, cities and companies across the country are considering, or have already implemented on a trial basis, the condensed schedule for their employees.

The economic downturn started the trend, as companies looked to avoid laying off employees, notes John Langmaid, organizer of an upcoming symposium on the issue for the Connecticut Law Review. Firms soon realized that when they closed on Fridays they could save money without having to reduce weekly hours. Indeed, Langmaid remarks, the idea of a four-day, 40-hour workweek "has been out there for quite some time as a response to environmental issues, commuting pressures, as well as work-family balance."

Local governments in particular have had their eyes on Utah over the last year; the state redefined the workday for more than 17,000 of its employees last August. For those workplaces, there's no longer a need to turn on the lights, elevators or computers on Fridays—nor do janitors need to clean vacant buildings. Electric bills have dropped even further during the summer, thanks to less air-conditioning: Friday's midday hours have been replaced by cooler mornings and evenings on Monday through Thursday. As of May, the state had saved \$1.8 million.

Perhaps as important, workers seem all too ready to replace "TGIF" with "TGIT". "People just love it," says Lori Wadsworth, a professor of public management at Brigham Young University in Provo. She helped survey those on the new Working 4 Utah schedule this May and found 82 percent would prefer to stick with it.

The environment seems to like it, too. "If employees are on the road 20 percent less, and office buildings are only powered four days a week," Langmaid says, "the energy savings and congestion savings would be enormous." Plus, the hour shift for the Monday through Thursday workers means fewer commuters during the traditional rush hours, speeding travel for all. It also means less time spent idling in traffic and therefore less spewing of greenhouse gases and other pollutants. The 9-to-5 crowd also gets the benefit of extended hours at the DMV and other state agencies that adopt the four-day schedule.

An interim report released by the Utah state government in February projected a drop of at least 6,000 metric tons of carbon dioxide emissions annually from Friday building shutdowns. If reductions in greenhouse gases from commuting are included, the state would check the generation of at least 12,000 metric tons of CO₂—the equivalent of taking about 2,300 cars off the road for one year.

Still, not everyone thinks a four-day workweek is good news. Some voice concerns that longer days in the office might lead to increased exhaustion and sickness, less time for working out as well as more frequent stops at fast food restaurants. So far, however, surveys suggest otherwise. "Utah employees actually show decreased health complaints, less stress and fewer sick days," Wadsworth says, noting previous research finding that fatigue is typically triggered by workdays over 12 hours. Early results from another multicity survey indicate that just 20 percent of respondents said they felt they ate more fast food and only 30 percent said they worked out less. In fact, 30 percent said they exercised more. Anecdotal evidence from Utah also points to an unexpected benefit: increased volunteerism.

As the yearlong experiment with this new model nears its end next month, employees of the cities of El Paso, Tex., and Melbourne Beach, Fla., among others, are following Utah's lead with their own TGIT trials. Struggling automakers have also spotted the potential savings. Starting August 10, General Motor's plant workers in Lordstown, Ohio, will work four 10-hour days a week. (It was the car industry—Henry Ford, in

particular—that made the five-day 40-hour workweek standard back in the 1920s and 1930s. Organized labor also helped drive federal legislation that in 1940 locked in a 40-hour week from what had commonly been more than 50 hours, and also banned child labor.)

New York, a state with higher energy costs and a workforce approximately 10 times larger than Utah's, might especially benefit from a four-day workweek, according to Michael N. Gianaris, a Democratic member of the New York State Assembly. Dealing with a "massive budget deficit," the state continues to look for "innovative ways to save money without causing pain to existing programs and raising taxes," says Gianaris, who introduced legislation to test the schedule among state employees. He sees growing momentum for the idea, which boasts "very little downside and a whole lot of upside."

"As we move further into the 21st century, governments need to look for ways to become more efficient. Moving to a four-day workweek should be at the top of the list," Gianaris says. "It helps the environment. People like it. It's a no-brainer."